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Sticky Prices: Why Firms Hesitate to Adjust the Price of Their Goods

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Price stickiness—the tendency of prices to remain constant despite changes in supply and demand—has been linked to firms' unwillingness to pay the costs entailed in setting, implementing, and advertising new prices. However, there is little consensus on the size and importance of these "repricing costs." Taking the imported beer market as their subject, the authors of this study find repricing costs to be markedly higher for manufacturers than for retailers and conclude that, at the wholesale level, these costs are a significant deterrent to price adjustment.

When Coca-Cola was first introduced in 1886, the price of a bottle was set at five cents. The Coca-Cola Company did not change this price again for more than seventy years, despite experiencing a number of large increases in its costs over the period—including a threefold rise in the price of sugar in the 1920s.[1] Although an extreme case, this example points to an issue that economists puzzle over: Why don't firms change their prices more often in response to changes in demand or supply? Economists refer to this phenomenon as price "stickiness" or "rigidity," and some attribute it to firms' unwillingness to pay the adjustment costs incurred in altering prices. These adjustment costs—also termed "repricing costs"—include the managerial time to determine a new optimal price, the cost of printing new price tags and of advertising a new price, and the risk of losing long-term customers when the price increases.

Adjustment costs may affect firms' pricing decisions in two ways. First, a firm might refrain from altering its price because its own repricing costs exceed the expected increase in revenues from such an action, even when all other competing firms adjust their prices. Second, if the firm believes that repricing costs will induce competing firms to keep their prices fixed, it may forgo a price adjustment for fear of losing market share. In the first case, the repricing costs have a direct effect on the firm's decisions; in the second, the effect is indirect, or "strategic."

While many economic models assume that firms must pay some fixed cost to adjust their prices, studies of pricing behavior have not reached a consensus on the magnitude and significance of these costs. The uncertainty stems in part from the difficulty of measuring the underlying factors that may cause firms to refrain from changing their prices following a cost increase. As former Federal Reserve Governor Alan Blinder and his coauthors (1998) observe in a recent book, "The most prominent theories of price stickiness rely on variables that are either unobservable in principle or unobserved in practice."[2]

Our objective—both in this edition of *Current Issues* and in the longer technical study on which this article is based[3]—is to derive a measure of the costs of repricing and to evaluate the importance of these costs in generating the observed price patterns. To accomplish this task, we focus on the pricing of imported goods. Imports are an

ideal subject of study because the markets for such goods are exposed to large and frequent exchange rate changes that should cause domestic prices to change. By examining whether firms do, in fact, adjust their prices in response to exchange rate changes, we can make some inferences about the magnitude of repricing costs. We then use this information to assess the importance of repricing costs relative to other factors in creating sticky prices.

Using data on the imported beer market in a structural model, we estimate the costs of repricing to be 0.4 percent of firm revenue for manufacturers and 0.1 percent of firm revenue for retailers. While these costs may not be large in absolute terms, they are of sufficient magnitude to discourage firms—primarily at the wholesale level—from altering their prices in response to an exchange rate change.

Our analysis also reveals how repricing costs compare in importance with two other sources of price rigidity for imported goods. The first of these is markup adjustment, or the tendency of manufacturers and retailers to moderate any increase in their prices in order to preserve their market share. The second is the existence of a "local" component in the price of imported goods, which consists of the costs of transporting, storing, and marketing goods once these goods have reached the destination market. Because these costs are denominated in the import country's currency (dollars in the case of U.S. beer imports), they do not fluctuate with the exchange rate. Like repricing costs, then, markup adjustments and local costs contribute to the stickiness of prices by limiting the degree to which those prices respond to exchange rate changes—or, in the language of economists, by rendering the transmission or "pass-through" of exchange rate changes to prices "incomplete." Our calculations suggest that of the incomplete exchange rate pass-through we observe in our sample of imported beer prices, 34 percent stems from markup adjustment, 54 percent from local costs, and 12 percent from repricing costs. Thus, although repricing costs are not the dominant source of incomplete pass-through, they are a substantial contributor to the low pass-through evident in the data.

A Methodology for Measuring Repricing Costs

To estimate the adjustment costs entailed in changing prices, we use store-level scanner data on beer prices, compiled over a four-year period in the mid-1990s.[4] The beer market is well suited for investigating questions related to price stickiness for two reasons: (1) highly detailed weekly data are available on both wholesale and retail prices, allowing us to examine how prices respond at each stage of the distribution chain; and (2) the data reveal that both wholesale and retail beer prices remain constant over periods of several weeks—an indication that price adjustment costs may indeed be a constraint in this market. The methodology we propose, however, is not tailored to the beer market, and can be more generally applied to any market for which data are recorded at frequent enough intervals to identify the points of price adjustment.

In addition, we choose to focus on the pricing of *imported* beers. In investigating the sources of price rigidity, it is best to look at markets in which the marginal (or per unit) increases in producer costs are sufficiently large to compel producers to consider raising their prices. In markets for imported goods, producers face large unanticipated cost changes from short-run exchange rate fluctuations. Indeed, exchange rates fluctuate by an order of magnitude more than do the prices of other inputs in the production of beer (Chart 1). Thus, this high exchange rate volatility is our assurance that we are studying goods whose producers must frequently decide whether to change their prices or their markups. A second advantage of studying imports is that exchange rate movements' pronounced effects on producer costs are easy to measure and independent of other developments in the market that might affect pricing.

A look at the price data for one imported beer—a popular British brand that we will call *Britannia*[5]—suggests the pricing patterns that are typical of many brands. Chart 2 tracks the retail and wholesale prices of a six-pack of *Britannia* over the full sample period, from the middle of 1991 to the middle of 1995. The weekly frequency of the data is ideal for analyzing the role of price stickiness, since we clearly see that prices remain constant for several weeks and then jump up (in a discrete step) to a new level.[6] Although the infrequent adjustment of prices is by itself no definitive proof that price rigidities exist,[7] the price movements in Chart 2 are exactly what one would expect if price stickiness was present.

[1]For details on the pricing of Coca-Cola, see Levy and Young (2005).

[2]See Blinder et al. (1998, p. 7).

[3]This article summarizes the findings of empirical work described in detail in Goldberg and Hellerstein (2007).

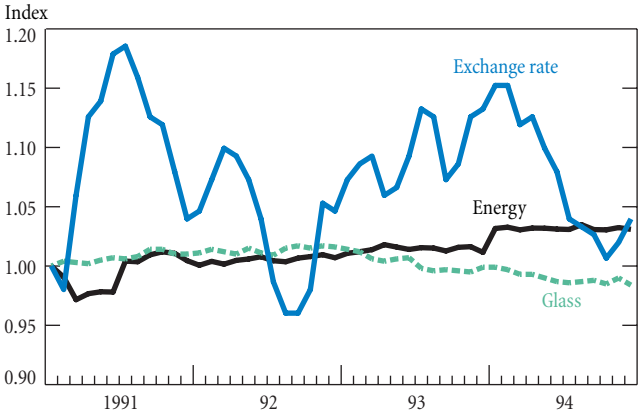
[4]Our data come from a major supermarket chain in the Chicago metropolitan area with a market share of roughly 20 percent. The data record the retail and wholesale prices for each product sold by the chain in 1991-95. The data can be found at <http://research.chicagogsb.edu/marketing/databases/dominicks/index.aspx>. They were gathered by the James M. Kilts Center for Marketing at the University of Chicago's Graduate School of Business.

[5]We adopt fictive names for each of the imported beer brands in our sample.

[6]The role of price stickiness cannot be analyzed within the framework that Goldberg (1995) and Goldberg and Verboven (2001) use to examine the auto market or the one that Hellerstein (2006) uses to study the beverage market. Since the frequency of the data used in these projects was either monthly or annual, the econometrician observes prices changing every period given price observations averaged over time. Thus, any price stickiness that may exist is not apparent or—put differently—cannot be identified from the data.

Chart 1

Volatility of the Exchange Rate and Input Prices for German Brewers

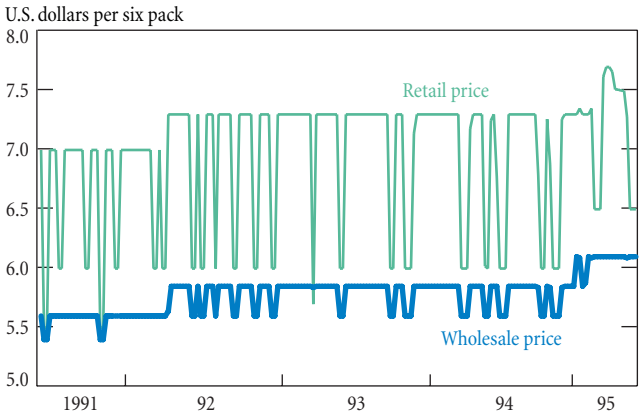


Sources: U.S. Bureau of Labor Statistics; Eurostat; IMF International Financial Statistics.

Note: Each series is normalized to 1 in January 1991.

Chart 2

Weekly Retail and Wholesale Prices for *Britannia* Beer



Source: University of Chicago Graduate School of Business, James M. Kilts Center for Marketing, <http://research.chicagogsb.edu/marketing/databases/dominicks/index.aspx>.

Another notable feature of Chart 2 is the fact that retail prices always adjust when the underlying wholesale prices adjust. Thus, it appears that the main reason retail prices in this market remain constant for long periods is that the costs facing retailers—as measured by the wholesale price—have not changed. The situation is very different, however, at the wholesale level: there, manufacturers keep prices unchanged despite the sharp changes in their costs created by exchange rate fluctuations. The implication is that price rigidity is driven largely by the behavior of wholesale prices.

In our empirical methodology, we use information from both the periods in which prices adjust and the periods in which prices remain unchanged to derive bounds on the repricing costs associated with a price change. The reasoning behind our approach is as follows: In periods in which prices change, it has to be the case that the costs of repricing are lower than the additional profit the firm makes by altering its price; we can use this insight to derive an upper bound for the repricing cost. Similarly, in periods in which prices do not change, it has to be the case that the costs of adjustment exceed the extra profit associated with a price change; using this insight, we can derive a lower bound for the repricing cost.

In addition to estimating the repricing costs, we also seek to quantify the importance of the two other sources of price stickiness identified in the introduction: markup adjustment and local costs. Recall that firms may adjust their markup—that is, refrain from fully passing through an exchange rate change to their prices—if they fear losing customers to the competition.[8] Similarly, the presence of local costs in the final price of imported goods—for the storage, transport, and marketing of goods in the import country—means that only a portion of the final price will fluctuate with exchange rate changes. Our methodology explicitly accounts for these alternative sources of price stickiness and measures their importance.

In assessing the significance of repricing costs, we examine their indirect or strategic effects on firms' pricing decisions as well as their direct effects. For example, if price changes are not synchronized across firms (and the empirical evidence suggests that they are not), even small adjustment costs can induce significant price rigidity: each firm may be unwilling to change its price materially if it assumes that its competitors will not change their prices. To evaluate the overall impact of repricing costs, we therefore consider the prices that firms would set following an exchange rate change in three different scenarios: the first with fully flexible prices, the second with price rigidities arising from a firm's own repricing costs, and the third with rigidities arising from a firm's assumptions about competitors' repricing costs. The difference between the response of prices in the first scenario, on the one hand, and the second and third, on the other, is attributed to the effect of repricing costs. The box explains our methodology in greater detail.

Results

We find repricing costs to be significant, both in magnitude and in the constraints they place on firms' price adjustments. Our calculations of the size of the repricing costs are reported in Table 1. The entries in the first and third columns report the mean of the upper bound on each brand's repricing cost as a share of its total revenue in a given

[7] In principle, prices may not change simply because nothing else changes.

[8] Note that throughout this article, our calculations of markup adjustments exclude the adjustments attributable to fixed repricing costs.

Empirical Methodology

The empirical methodology of this article and its companion technical study builds on Goldberg (1995), Goldberg and Verboven (2001), Hellerstein (2006), and Nakamura (2007). The methodology involves estimating first the demand for the industry's product, independently of the supply side, and subsequently the supply side of the model. Assuming that firms act as period-by-period profit maximizers implies a set of first-order conditions that can be estimated (once the demand-side parameters are estimated) to back out the marginal costs and markups in the industry, including separate traded and nontraded (local) components. This decomposition allows one to examine how the particular components of prices (traded cost component, nontraded cost component, and markup) respond to exchange rate or other cost changes.

A key element of our approach, which is fully documented in Goldberg and Hellerstein (2007), is to allow firms to deviate from their first-order conditions because of the existence of fixed costs of repricing. The underlying premise is that once a firm decides to incur the adjustment cost associated with a price change, it will set the product's price according to the first-order conditions of its profit maximization problem. The estimation takes into explicit account that each firm's behavior is affected by the existence of price rigidities and by the behavior of competitors.

Once the model is estimated, we exploit information from both the periods in which prices adjust and the periods in which prices remain unchanged. The principal insight is that in periods in which prices change, the costs of repricing must be lower than the additional profit the firm makes by altering its price, while in periods in which prices do not change, the repricing costs must exceed the extra profit associated with a price change. Hence, using this methodology, we can derive lower and upper bounds for the costs of repricing.

week. As our look at the data on beer import prices would lead us to expect, manufacturer (wholesale) repricing costs are generally larger as a share of revenue than retail repricing costs: The upper-bound estimates of manufacturers' repricing costs range from 0.3 percent of revenue for *Mexicana* to 3.2 percent of revenue for *Germania*, with a mean of 2.2 percent of revenue across all foreign brands. The upper-bound estimates of repricing costs for retailers range from 0.1 percent of revenue for *Hollandia* to 0.4 percent of revenue for *Germania*, with a mean upper bound across foreign brands of 0.4 percent.[9]

The second and fourth columns of Table 1 report the sum of the upper bounds for each brand's repricing costs, computed over only those periods in which prices changed, divided by the total manufacturer or retail revenue for that

Table 1
Repricing Costs as a Share of Brand Revenue
Percent

	Manufacturer		Retailer	
Beer Brand	Mean	Total	Mean	Total
Britannia	2.456 (.499)**	0.313 (.091)**	0.302 (.215)	0.079 (.064)
Germania	3.196 (.060)**	1.127 (.208)**	0.379 (.332)	0.208 (.179)
Mexicana	0.269 (.128)*	0.060 (.039)	0.078 (.054)	0.020 (.022)
Hollandia	0.306 (.386)	0.210 (.024)**	0.096 (.057)	0.029 (.019)
Overall	2.157 (.373)**	0.443 (.077)**	0.370 (.232)	0.121 (.009)**

Source: Authors' calculations.

Notes: The values reported are upper-bound estimates. Standard errors from bootstrap simulations appear in parentheses.

*Significant at the 5 percent level.
**Significant at the 1 percent level.

brand, computed over the full sample period. The sum of repricing costs across all foreign brands is 0.4 percent of total revenue for manufacturers and 0.1 percent of total revenue for retailers.[10]

In the next step of our analysis, we conduct a simulation exercise to quantify the contribution that repricing costs, local costs, and markup adjustments make to price stickiness. Specifically, we simulate the effects of a 1 percent appreciation of the relevant foreign currency on the price of our British, German, Mexican, and Dutch imported beers and track how each of the three factors reduces the degree to which the exchange rate change is passed through to the price at different stages of the distribution chain. (These computations are explained in greater detail in Goldberg and Hellerstein [2007].) Our results are reported in Table 2, where each panel corresponds to one of the three simulations we run.

Simulation 1

We begin by simulating the price effect of a 1 percent appreciation of the relevant foreign currency under the assumption that manufacturers and retailers face no repricing costs

[9]The lower bounds we compute, which we do not report here, are indistinguishable from zero across brands for both wholesale and retail prices.

[10]These numbers are close to those reported by Levy et al. (1997) and Dutta et al. (1999), who use a similar procedure that divides the costs of repricing, calculated only for those periods when prices changed, by the revenue earned by the firm across all periods, whether prices changed or not. These studies report retailer fixed costs of repricing to be 0.70 and 0.59 percent of revenue, respectively. Note, however, that because our repricing costs are defined very generally to include all factors that may prevent firms from changing their nominal prices (not just the labor and material costs of changing prices), our numbers are not directly comparable to those of Levy et al.

Table 2

Contribution of Repricing Costs to Price Stickiness following an Exchange Rate Change

Simulated Effect of a 1 Percent Foreign Currency Appreciation

	Percentage of Exchange Rate Increase Passed Through to			
	Wholesale Prices		Retail Prices	
	After Accounting for		After Accounting for	
Beer Brand	Local Costs	Markup Adj.	Local Costs	Markup Adj.
	Assuming no repricing costs			
Britannia	50.1 (.000)**	13.1 (.0995)	11.2 (.0878)	11.3 (.1251)
Germania	50.1 (.000)**	16.3 (.1108)	13.5 (.1006)	13.4 (.1243)
Mexicana	50.1 (.000)**	29.9 (.0728)**	26.3 (.0632)**	25.5 (.1236)**
Hollandia	50.1 (.000)**	33.4 (.0641)**	27.1 (.0544)**	26.7 (.1160)**
All	50.1 (.000)**	18.3 (.1040)	15.4 (.0906)	14.3 (.1326)
	Assuming own-brand repricing costs			
Britannia	50.1 (.000)**	0.0 (.000)	0.0 (.000)	0.0 (.000)
Germania	50.1 (.000)**	0.0 (.000)	0.0 (.000)	0.0 (.000)
Mexicana	50.1 (.000)**	29.9 (.0728)**	26.3 (.0632)**	25.5 (.1236)**
Hollandia	50.1 (.000)**	33.4 (.0641)**	27.1 (.0544)**	26.7 (.1160)**
All	50.1 (.000)**	8.3 (.0632)	6.2 (.0344)	6.0 (.0566)
	Assuming competitor-brand repricing costs			
Britannia	50.1 (.000)**	0.0 (.000)	0.0 (.000)	0.0 (.000)
Germania	50.1 (.000)**	0.0 (.000)	0.0 (.000)	0.0 (.000)
Mexicana	50.1 (.000)**	29.4 (.0728)**	26.1 (.0632)**	25.2 (.1236)**
Hollandia	50.1 (.000)**	32.1 (.0641)**	26.6 (.0544)**	25.9 (.1160)**
All	50.1 (.000)**	6.8 (.0510)	5.3 (.0302)	5.0 (.0310)

Source: Authors' calculations.

Notes: The table reports pass-through rates across 404 simulations. Standard errors from bootstrap simulations appear in parentheses.

**Significant at the 1 percent level.

(Table 2, top panel). Only 50 percent of the exchange rate increase is passed through to the manufacturer's total cost[11] after accounting for local costs (column 1). This finding is based on calculations in our longer, technical study showing that the average local cost incurred by foreign manufacturers for transportation, marketing, and similar services is roughly 50 percent of their total costs. Thus, the median pass-through value of 50 percent means that only half of the manufacturer's total costs will increase with the currency appreciation; the remainder, consisting of local costs denominated in dollars, will be insulated from the exchange rate change. After manufacturer markup adjustments are taken into account (column 2), the percentage of the exchange rate increase that is passed through to wholesale prices declines substantially. To be sure, the markup adjustments vary widely across brands: the median pass-through rate of the currency appreciation ranges from 13.1 percent for *Britannia* to 33.4 percent for *Hollandia*. But the median pass-through value *across all brands*—only 18.3 percent—suggests that markup adjustments do play a large role in keeping wholesale prices rigid.

When retailer local costs—such as store maintenance, wages, and local advertising—are taken into account (column 3), the median pass-through rate edges down to 15.4 percent across all brands and ranges from 11.2 percent for *Britannia* to 27.1 percent for *Hollandia*. Finally, the inclusion of the retailer's markup adjustment lowers the pass-through rate to 14.3 percent across all brands; retail pass-through ranges from 11.3 percent for *Britannia* to 26.7 percent for *Hollandia*.

Simulation 2

Our second simulation assumes that only the manufacturer of the foreign brand affected by the exchange rate change faces fixed repricing costs, while the prices of all other brands adjust freely (Table 2, middle panel). This experiment essentially tests what we have described as the *direct* effects of repricing costs on manufacturers' pricing decisions. In other words, the experiment asks, What percentage of the currency appreciation will manufacturers pass through to their prices once they compare their repricing costs with the increased revenue they would expect from raising their prices? In this simulation, we incorporate our estimates of the magnitude of repricing costs for the different beer brands.

Looking at the first column, we see that the percentage of the currency appreciation that is passed through to the manufacturer's total cost is again 50 percent once we adjust for the dollar-denominated local costs that are unaffected by the exchange rate change. But the pass-through rate to wholesale prices, shown in the second column, now varies significantly across brands depending on whether repricing costs are large enough to deter individual manufacturers from raising their wholesale prices. The median pass-through rate for *Mexicana* and *Hollandia* (interestingly, the imports with the highest market share) is about 30 percent. By contrast, for *Britannia* and *Germania*, the two brands that had the highest repricing costs, the pass-through rate is 0 percent—meaning that the manufacturers of these beers leave their wholesale prices unchanged.

The percentage of the currency appreciation that is passed through to retail prices is naturally 0 percent for the two

[11] Note that "manufacturer's total cost" always refers to marginal costs and does not include any fixed costs.

brands whose manufacturers refrained from changing their wholesale prices. For *Mexicana* and *Hollandia*, the pass-through rates are roughly 26 and 27 percent, respectively, once the retailer local costs are taken into account, and slightly lower once retailer markup adjustment is factored in.

Across all four brands of beer, the median pass-through to final retail prices is only 6.0 percent. Thus, taking into account a brand's own repricing costs reduces the percentage of the currency appreciation transmitted to prices from 14.3 percent (simulation 1) to 6.0 percent (simulation 2). This reduction provides a measure of the direct contribution that repricing costs make to sticky prices. Note that the reduction stems from the manufacturers' recognition that the cost of altering the wholesale price of *Britannia* and *Germania* exceeds the expected increase in profits; retail repricing costs for these brands do not contribute to any further reductions in the pass-through rate.

Simulation 3

The third simulation assumes that repricing costs are a constraint not only for the manufacturer whose brand is affected by the foreign currency appreciation but also for the manufacturer's competitors. This experiment tests the *indirect* or *strategic* effects of repricing costs by asking whether manufacturers and retailers adjust their prices following a 1 percent appreciation of the relevant foreign currency if they take their competitors' prices to be fixed. As before, high repricing costs prompt the manufacturers of *Britannia* and *Germania* to forgo any adjustment of their wholesale prices; the pass-through rate is zero (column 2). But what is different in this simulation is that the pass-through rates for those brands whose prices do adjust—*Mexicana* and *Hollandia*—have fallen relative to their values in simulation 2. This additional reduction in the pass-through rates, seen at both the wholesale and retail level, is a measure of the indirect effect of repricing costs: Because firms assume that repricing costs will prevent their competitors from raising their prices, they will moderate their own price increases more than they would under fully flexible prices. Overall, this effect accounts for the reduction of the wholesale pass-through rate across all brands (column 2) from 8.3 percent in simulation 2 to 6.8 percent in simulation 3, and the reduction of the retail pass-through rate across all brands (column 4) from 6.0 percent in simulation 2 to 5.0 percent in simulation 3.

Taken together, the three simulations underscore the importance of repricing costs in one other way. The actual pass-through rate to wholesale prices observed in our 1991-95 sample is between 6 and 7 percent. Our first simulation suggests that local costs and markup adjustments together reduce pass-through at the wholesale level to 18.3 percent. However, when we add repricing costs to our model (in the second and third simulations), the pass-through rate to wholesale prices drops to 6.8 percent, matching the rate documented in the data.

A Breakdown of the Sources of Price Rigidity

We have seen that repricing costs, local costs, and markup adjustments all contribute to the stickiness of import prices. They do so by inhibiting the pass-through of exchange rate changes to wholesale and retail prices. In this section, we use the results of our simulations to compute the share of the incomplete transmission of our 1 percent foreign currency appreciation that can be attributed to each of the three factors.

Manufacturers' local costs play the most significant role in the incomplete transmission of the original cost increase to retail prices (Table 3). Following a 1 percent appreciation of the relevant foreign currency, these costs are responsible for roughly half, or 52.5 percent, of the observed retail price rigidity. Manufacturers' markup adjustments account for 33.5 percent of the remaining rigidity, and manufacturers' own repricing costs for another 10.5 percent. At the retail level, roughly 1.6 percent of the incomplete pass-through is attributable to local costs; retailers' markup adjustments and own repricing costs have a negligible role in explaining the incomplete transmission. Finally, the competitive effects of rival brands' repricing costs account for 1.6 and 0.1 percent

Table 3
Breakdown of the Incomplete Pass-Through of a 1 Percent Foreign Currency Appreciation to Consumer Prices
Percent

	Share Attributable to Manufacturers'				Share Attributable to Retailers'			
Beer Brand	Local Costs	Markup Adjustment	Own Repricing Costs	Competitor Repricing Costs	Local Costs	Markup Adjustment	Own Repricing Costs	Competitor Repricing Costs
Britannia	49.9	37.0	13.1	0.0	0.0	0.0	0.0	0.0
Germania	49.9	33.8	16.3	0.0	0.0	0.0	0.0	0.0
Mexicana	66.7	27.0	0.0	0.7	4.4	1.1	0.0	0.1
Hollandia	67.3	22.5	0.0	1.8	7.4	0.5	0.0	0.4
All	52.5	33.5	10.5	1.6	1.6	0.2	0.0	0.1

Source: Authors' calculations.

Note: The table reports median values across 404 simulations.

of the incomplete pass-through by manufacturers and retailers, respectively. These results support the initial impression formed from the data (see Chart 2): the effects of repricing costs are most evident in the infrequent change of wholesale prices, while such costs play only a minor role in explaining the stickiness of retail prices.

As we have observed, repricing costs may affect the pricing decisions of a particular producer in direct and indirect ways. Our simulations indicate that the direct effect is significant at the wholesale level, accounting for 10.5 percent of the incomplete pass-through on average. In contrast, at the retail level, firms' own costs of repricing have no effect—a finding that accords with the small magnitude of repricing costs we estimate for retailers. There is, however, an indirect effect at this stage of the distribution chain that accounts for approximately 0.1 percent of the incomplete pass-through. Thus, it seems that the direct effect of repricing costs is only significant at the wholesale level, while the indirect effect plays a role at both the wholesale and the retail level.

Our final breakdown of the sources of price stickiness attributes 54.1 percent of the incomplete pass-through to local costs (52.5 percent at the wholesale and 1.6 percent at the retail level), 33.7 percent to markup adjustment (33.5 percent at the wholesale and 0.2 percent at the retail level), and 12.2 percent to the existence of repricing costs, 1.7 percent of which represents the indirect or strategic effect of such costs.

Conclusion

What accounts for the resistance of prices to change? In this article, we conduct simulation exercises to identify the relative importance of various sources of price stickiness for imported goods. We find that the rigidity of prices is driven primarily by the behavior of wholesale prices. At the wholesale level, manufacturers' local costs play the largest role in reducing price changes, and markup adjustments also contribute heavily. However, these two factors alone cannot completely explain the infrequent price adjustment we observe. Indeed, it is only when we include repricing costs in our simulations of the price effects of a foreign currency appreciation that our results match the pass-through rates we observe in the data. Thus, repricing costs—the costs involved in setting, implementing, and advertising new prices—emerge as an important deterrent to price adjustments, particularly for manufacturers.

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