An Analysis of Asymmetric Consumer Price Responses and Asymmetric Cost Pass-Through in the French Coffee Market

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Résumé

We analyze empirically a possible channel for the existence of asymmetric price-cost pass-through, that is, of prices responding differently to negative and positive upstream cost shocks. While asymmetric price-cost pass-through has been documented in many markets, possible causes for such a phenomenon have not empirically investigated. Using consumer panel data in the coffee retail sector in France, we estimate a demand model structurally allowing for asymmetric consumer responses to positive and negative retail price changes. According to the demand estimates, we indeed find significant evidence that consumers react differentially to positive and negative price movements, in that demand is less sensitive (elastic) to price increases than to price decreases. Then using counterfactual simulations within an equilibrium model of demand and supply side behavior we empirically investigate to what extent the existence of the estimated demand asymmetries contributes to asymmetric responses of equilibrium prices of imperfectly competing firms given upstream negative and positive cost shocks. We do so by simulating positive and negative costs shocks, given the estimated demand model with asymmetric demand responses. We compare the changes in prices to changes in prices resulting from the same magnitude of cost shocks in an alternative demand structure without demand asymmetries. Our findings suggest that not allowing for asymmetries in demand imply similar magnitudes of simulated price-cost pass-through rates. However, when allowing there to be demand asymmetries, a positive cost shock is passed through to a larger degree to retail prices than a negative cost shock of the same magnitude. Our findings imply that the shape of the demand explains observed asymmetric price transmission of cost shocks in the context of imperfectly competitive markets.

JEL codes : L11, L19, L89

Key words : Retail grocery sector, Pass-through, Asymmetric Price Responses.

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1 Introduction

Although according to standard economic price theory, there is no foundation for prices to adjust asymmetrically to cost upturns relative to downturns, empirical findings suggest there to be in fact such asymmetric price responses in a variety of markets (for a survey see Meyer and Cramon-Taubadel, 2005). For example, Borenstein et al. (1997) in the U.S., and Noel (2009) for the Canadian market, found that gasoline prices tend to respond faster to crude oil increases than to decreases. In a cross market study for 77 consumer goods and 165 producer goods Peltzman (2000) finds there to be asymmetric price adjustment more generally than one would think : on average, the short term response to a positive cost shock is at least twice the magnitude of the response to a negative shock ; and that symmetry in price adjustments is rather an exception among the goods considered.

The occurrence of asymmetric price transmission has important welfare and, hence, policy implications. If for example, firms do not pass on the price reductions, consumers may not benefit as much expected from policy reforms involving say a tax reduction. Beyond documenting the occurrence, understanding the causes behind such a phenomenon is also an important step for policy. Although there are many potential causes advanced to explain the phenomenon of asymmetric and imperfect pass-through (such as menu costs, market power, inventory, as in Peltzman, 2000) to date there is a lack of empirical work establishing causal relationships between possible factors leading to asymmetric price transmission. In an attempt to investigate heterogeneity in the degree of asymmetric price transmissions across markets, Peltzman (2000) investigates in a reduced form setting possible correlates with asymmetric price transmission. He finds significant heterogeneity in the degree of asymmetry, moreover, the degree of asymmetry is negatively correlated with input price volatility, and his results find no significant correlation between the asymmetries and proxies measuring inventory costs, the existence of menu costs, and market power in these markets. In the policy debate asymmetric price transmission is very often considered a result of the abuse of market power (Meyer and Cramon-Taubadel, 2005).[1] In oil markets, for instance, the recent policy debate centers on whether a reduction in gasoline taxes would result in gasoline price reductions at the pump. The concern there would be that the firms involved in refining and distributing gasoline would strategically adjust their margins resulting in a less than complete pass-through of the tax reduction into final gasoline prices (The New York Times, April 2008).

Since the empirical method used to detect this asymmetric price transmission in Peltzman (2000), and in similar past related studies (e.g. to be added), is reduced form, it does not allow us to investigate formally the possible causes of asymmetric price transmission. Given available observational non experimental data, indeed reduced form approaches may find, at most, correlated factors and not causal factors. The contribution of the present paper is to propose a formal framework and estimate a structural model that allows us to investigate, via counterfactual simulations, possible causes of asymmetric price transmission in the markets. In particular, we highlight the possible role of asymmetries in demand as causes of asymmetric firm price transmission of upstream cost shocks into retail prices consumers observe. The intuition is that, if firms face demand asymmetries, in terms of a much larger response to a price increase than to a price reduction of similar magnitude, they be more reluctant to pass through price increases in the same rate as price savings into final retail prices.

Our work builds on the efforts by previous papers that find and document the existence of demand asymmetries. Müller and Ray (2007) show that asymmetric price adjustment exists in a retail grocery chain of Chicago. Krishnamurthi, Mazumdar and Raj (1992) suggest that consumers would react more to perceived prices losses than to price gains in their quantity choice and that only loyal consumers responds differently to gains and losses in brand choice decisions. Kalyanaram and

[1] According to the survey in Cramon-Taubadel and Meyer (2001) asymmetric price transmission is related to concentration in the slaughter industry and retail sector.

Little (1994) identify a region of indifference such that changes in price within this region produce no changes in perception (price thresholds) due to historical benchmark price (consumers remember the price encountered on past purchase occasions) or competitive benchmark price (a benchmark price is formed during the purchase occasion on the basis of the price observed, i.e. shelf prices of competing products). Han, Gupta, Lehmann (2001) find asymmetric thresholds and particularly larger thresholds for price decrease versus price increase in the coffee category. Pauwels, Srinivasan and Franses (2007) find evidence for asymmetric thresholds and for different sign and magnitude of elasticity transitions in a large supermarket of Chicago. Price thresholds can be justified by adaptation level theory, saturation effects and brand loyalty. In the case of a negative price gap, that is equivalent to a consumer gain, even though consumers perceive and recognize discounts, they may not react strongly if they are waiting for still better deals (Kalyanaram and Little, 1994 ; adaptation level theory). Moreover, saturation effects for gains (Gupta and Cooper, 1992) in retail market may originate from consumer limits to purchasing, transporting, and stockpiling products. For a positive price gap, that is equivalent to a consumer loss, the loss must exceed a consumer's price threshold in order to be perceived (Kalyanaram and Little, 1994 ; adaptation level theory). The loyal consumer may not react if the need or desire for his preferred good is strong enough (Jacoby and Chestnut, 1978 ; brand loyalty).

The approach followed in this paper consists of two steps, where in the first we estimate a demand model allowing for the possibility of asymmetric demand price sensitivities along the above mentioned literature. In doing so, using consumers' actual purchase data and price variation, we assess the asymmetric price response of consumers in their brand choice in the French Coffee Market. Given the estimated demand model, we investigate in a counterfactual framework, whether the estimated asymmetric price demand model would result in firm level simulated asymmetric cost pass-through, and estimate the magnitude of the asymmetry in price cost transmission as a function of demand behavioral factors.

Furthermore, the structural econometric models used allow us to account for the structure of this industry, and in particular the horizontal and vertical interactions between manufacturers and retailers. From estimates of consumers' demand on the French Coffee Market, we are able to recover price cost margins and estimated marginal costs from a supply model as in Bonnet and Dubois (2010). While assumptions on relationships between manufacturers and retailers and on vertical restraints may change the magnitude of the retail price transmission as Bonnet et al. (2013) show, we are not focused here on the level of pass-through per see, namely, we are interested in the identification of asymmetries in cost pass through. Thanks to simulations of cost shocks, we estimate cost pass-through and by implementing positive and negative cost shock simulations, we will test the asymmetry of cost pass-through.

Section 2 describes the French Coffee market and available data. Section 3 presents the estimation method allowing to estimate asymmetric price response of consumers and asymmetric price threshold in their brand choice behavior. Section 4 develops the method used to estimate cost pass-through by recovering price-cost margins, estimating marginal costs and simulating cost shock. Section 5 describes demand results, asymmetric consumer behavior and asymmetric pass-through, while section 6 concludes.

2 French Coffee Market and Data

We focus our empirical analysis on the French Coffee Market during the period 1998-2006, a market that is third in the world. In 2006, behind USA and Germany, the French per capita average consumption amounts to 5 kilograms per year and then consumption stagnates in the last decade. During this long period of analysis we take advantage of price variations on raw coffee price and product prices. As Figure 1 shows, in the raw coffee price (composite indicator price of the International Coffee

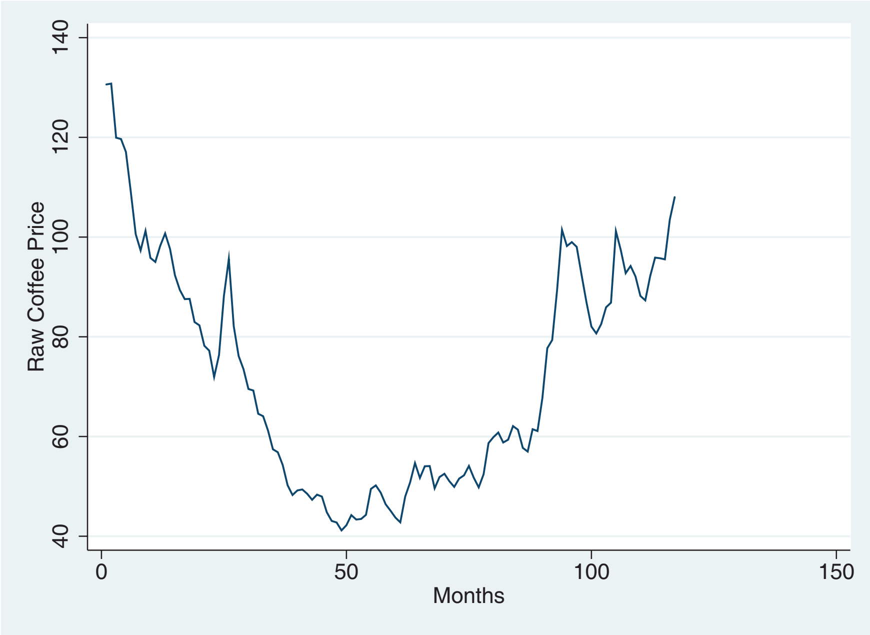


Fig. 1 – Raw Coffee Price from 1998 to 2006

Organization in US cents per lb), we have a global decrease until 2001, then a global increase, and there are a lot of ups and downs.

Figure 2, that represents the evolution of raw coffee price and brand prices in a retailer, shows an asymmetric product price adjustment when raw coffee price decreases or increases and also shows that price variations of coffee products on the French market are product specific. Raw coffee price increases seem to be more transmitted than raw coffee price decreases.

Table 1 presents a reduced form analysis of retail price on raw coffee price where we see the impact on retail price being larger when we observe an increased raw price than a decreased one. Indeed, Raw^+ represents the raw coffee price interacted with a dummy which is equal to one if the raw coffee price at the period t is larger than the raw coffee price at period t-1. Raw^- is the raw coffee price in the case of negative change. The coefficient related to Raw^+ is indeed larger meaning that raw coffee prices impact more retail prices when they increase rather than they decrease. From the reduced form estimates we conclude that the French Coffee market consists of an interesting market to analyze the possible forces behind asymmetric price transmission of a cost shock into retail prices.

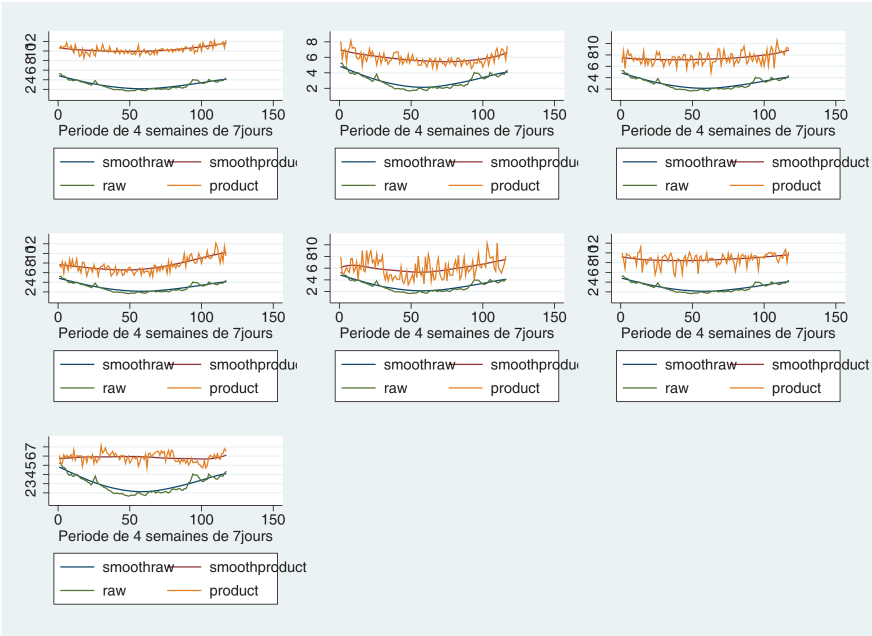


FIG. 2 – Raw coffee price and brand prices in a retailer.

TAB. 1 – **Reduced form analysis of the impact of raw price on coffee retail price.**

Price	Mean (std)	Mean (std)
Raw	0.008 (0.002)	
Raw^+		0.011 (0.002)
Raw^-		0.007 (0.002)
Product fixed effects	Yes	Yes
Time fixed effects	Yes	Yes
R^2	0.75	0.75

The French coffee market is concentrated at both the manufacturer and the retailer levels. The retailing industry of the French Coffee market represents 90% of the total consumption of coffee and is composed of seven main retailers (70% of the coffee purchases in the data) and four main manufacturers which produce six national brands (71% of the coffee purchases in the seven main retailers in our data). Market shares of the six brands vary from 2.5% to 10%. We take into account private labels of retailers on this market which represent 14% of the market share of our sample. On average, the 49 products considered, which are defined as a brand in a retailer, represent 52% of the total purchases each period, where a period consists of 4 weeks.

The data used in this paper are collected by TNS WordPanel and market shares, prices, and promotion rates for all products at each period are computed from household coffee purchases from 1998 to 2006. We also are able to compute from the consumer purchases the characteristics of the product such as the rate of Arabica coffee and ground coffee. In our data, during the period 1998-2006, we have roughly 50% of price increases. This proportion is the same for all brands and all retailers considered in this paper, except for brand 4 where the proportion of price increases is lightly greater (55%). Descriptive statistics of these data are presented in Table 2 and 3. There is some heterogeneity in patterns of average price and market shares among brands. Prices are between €5.02 and €9.60 and market shares between 2.69% and 14.30%. Brand 1 is the most expensive, which could be explained by the weakest promotion rate (9.77%) and the higher rate of Arabica coffee. Brand 5 is the cheapest and has the highest promotion rate (38.69%). The private label product is sold at €5.49 on average and has the higher market shares. Interestingly there is no heterogeneity in price across retailers despite a large heterogeneity in market shares among them. For Arabica, bean and caffeine-free coffee types we note that there is little heterogeneity among purchases in the different retailers. In terms of product purchases, 60% originate from Arabica coffee for all retailers, 1.7% are bean coffee

Tab. 2 – **Descriptive Statistics.**

	Prices in € (std)	Shares in % (std)	Promotion rate in % (std)	Arabica coffee rate in % (std)	Robusta coffee r[ate] in % (std)
Brands					
B1	9.60 (0.73)	9.26 (2.16)	9.77 (9.60)	99.92 (0.62)	0
B2	5.43 (0.81)	7.76 (1.98)	27.20 (17.16)	32.28 (12.53)	0.05 (0.39)
B3	7.41 (1.05)	7.09 (1.27)	22.27 (11.54)	65.63 (1.30)	14.45 (10.49)
B4	7.51 (1.53)	10.20 (2.38)	21.49 (11.19)	66.50 (12.23)	0.05 (0.42)
B5	5.02 (1.29)	2.97 (0.92)	38.69 (24.37)	42.55 (23.67)	5.16 (11.61)
B6	8.30 (1.23)	2.69 (0.43)	16.30 (13.03)	75.19 (14.16)	0.01 (0.20)
B7	5.49 (0.67)	14.30 (2.46)	12.05 (9.06)	58.19 (14.82)	10.41 (14.28)
Retailers					
R1	6.67 (1.91)	6.80 (1.07)	26.48 (17.64)	59.88 (25.38)	4.96 (11.60)
R2	6.86 (2.05)	9.24 (1.50)	22.69 (17.90)	63.16 (25.26)	4.86 (9.61)
R3	7.17 (1.84)	5.37 (1.75)	15.74 (14.11)	62.33 (23.92)	7.15 (14.28)
R4	7.15 (1.93)	10.63 (1.67)	15.87 (12.92)	61.69 (25.26)	4.00 (6.26)
R5	6.67 (1.76)	13.55 (1.76)	23.75 (17.11)	62.50 (24.74)	3.11 (6.96)
R6	7.08 (1.83)	5.19 (1.24)	19.41 (16.83)	65.30 (23.80)	4.12 (9.68)
R7	7.18 (1.98)	3.49 (0.96)	23.61 (19.71)	65.62 (24.77)	1.93 (5.95)
Outside Option		45.69			

and the caffeine-free product purchases are around 10%. The only heterogeneity remains in the Robusta coffee rate (from 1.93% to 7.15% in average).

3 Estimation Method of the Asymmetric Consumer Price Response

3.1 Demand Model

Motivated by the upwards and downwards price movements, we specify a model of consumer behavior allowing asymmetric demand responses to price changes, where we extend accordingly a standard brand choice model such as a random coefficients logit model as in Berry, Levinsohn, Pakes (1995) and Nevo (2001). This model allows flexible substitution patterns with respect to the standard multinomial logit model taking account for consumer heterogeneity. We assume that I consumers can choose among J products during T periods. The utility of a consumer i purchasing the

Tab. 3 – **Descriptive Statistics (cont.).**

	Bean coffee rate in % (std)	Caffeine-free coffee rate in % (std)
Brands		
B1	2.52 (2.37)	8.40 (4.72)
B2	1.34 (1.90)	16.92 (7.36)
B3	2.69 (3.13)	11.09 (6.65)
B4	1.49 (1.63)	11.25 (5.40)
B5	0.81 (4.75)	3.32 (6.28)
B6	0.24 (1.07)	7.49 (8.11)
B7	2.08 (2.21)	13.75 (6.95)
Retailers		
R1	1.37 (2.25)	10.91 (8.88)
R2	1.56 (2.37)	9.12 (6.42)
R3	2.04 (4.64)	10.01 (7.58)
R4	1.73 (2.47)	10.93 (7.79)
R5	1.67 (1.92)	11.12 (6.47)
R6	1.68 (2.95)	11.30 (8.72)
R7	1.13 (1.93)	8.91 (7.64)

product j at period t can be written as :

$$U_{ijt} = V_{ijt} + \varepsilon_{ijt} = \delta_j + \eta_t - \alpha_i p_{jt} + X_{jt}\beta_x + \xi_{jt} + \varepsilon_{ijt},$$

where δ_j is a product fixed effect capturing time invariant product characteristics, η_t is a time fixed effect allowing to capture seasonal variations and trend of coffee consumption, p_{jt} is the price of the product j at period t and α_i represents the consumer marginal utility for price or price sensitivity, X_{jt} are observed product characteristics and β_x are the corresponding marginal utility coefficients. The term ξ_{jt} accounts for monthly changes in factors such as shelf space, positioning of the product among others that affect consumer utility, that are observed by consumers and firms but are not observed by the researcher. Finally ε_{ijt} is an i.i.d. type I extreme value distributed error term capturing consumer idiosyncratic preferences.

We allow for unobserved household heterogeneity in the price sensitivity through a random component $\nu_i \sim N(0, 1)$ in α_i and for an asymmetric consumer price response through both coefficient α^1 and α^2. The coefficient of price variable is then given by

$$\alpha_i = \left(\alpha^1 + \alpha^2 1_{[p_{jt} - p_{jt-1} > 0]}\right) + \sigma\nu_i. \qquad (1)$$

We suppose that the reference price of consumers is only the last price observed. This adjustment implies that consumers make an immediate and complete adjustment in their price expectations after an exposure to a price stimulus.

We introduce an outside good option, denoted good 0, to allow the possibility of consumer i not buying one of the J marketed products and suppose that the utility is given by :

$$U_{i0kt} = \varepsilon_{i0kt}.$$

Let the distribution of ν_i across consumers be denoted by $F(\nu_i)$. The aggregate share S_{jt} of product j at period t across all consumers is obtained by integrating the consumer level probabilities :

$$S_{jt} = \int \frac{\exp(V_{ijt})}{1 + \sum_{k=1}^{J} \exp(V_{ikt})} dF(\nu_i). \qquad (2)$$

This demand model implies own- and cross-price elasticities and we will investigate empirically if there exists an asymmetric behavior in the observed price responses of consumers.

3.2 Estimation and identification of Demand

To estimate the set of parameters $\theta = (\delta_j, \eta_t, \beta_x, \alpha^0, \alpha^1, \sigma)$, we use the GMM method as in Nevo (2001) and solve the endogeneity problem of prices by using input prices as instrumental variables such as oil, raw coffee price, Arabica and Robusta coffee price interacted with national brand product dummies or private label product dummy variables. Raw coffee prices are a composite indicator prices computed by the International Coffee Organization and average composite prices for Arabica's and Robusta's group. The oil price index is given by the French National Institute for Statistics and Economics Studies (INSEE). The interaction of input prices with national brand or private label product dummies aims at capturing the fact that the cost of input may differ according to the brand and particularly differ between national brands and private labels.

4 Counterfactual simulation Method of Cost Pass-Through

In this section, after deducing the price elasticities given demand and resulting price cost margins given the supply model, we then compute estimated marginal cost by subtracting estimated margins from observed prices. Thanks to simulations comparing equilibrium prices in both cases, with and without a cost shock on the estimated marginal costs, we are able to estimate cost pass-through. We will then estimate the cost-price pass-through in both cases of positive and negative upstream cost shocks and we will examine whether we obtain simulated significantly different magnitudes in price changes. Finally, we perform these simulations given the estimated demand model allowing for demand asymmetric price responses, and confront the price-cost pass through patterns for negative and positive cost shocks shutting down demand asymmetries using a counterfactual demand model.

4.1 Supply Model

Given the market considered, we assume an oligopoly model of two part tariff contracts between manufacturers and retailers to estimate price-cost margins and marginal costs. This model introduced theoretically by Rey and Vergé (2010) and empirically implemented in Bonnet and Dubois (2010) allows us to derive price-cost margins in the case where we assume resale price maintenance with respect to linear pricing contracts, that are usually used. Moreover, these two part tariffs contracts with resale price maintenance are considered in several empirical studies of vertical contracts as a better model than the linear pricing one or two part tariff contracts without resale price maintenance (Bonnet and Dubois, 2008 and 2010 ; Bonnet et al., 2013 ; Bonnet and Requillart, 2013).

Manufacturers offer two-part tariffs contracts which consists of wholesale prices w_j and franchise fees F_j paid by the retailer for selling the product j to the manufacturer but also retail prices p_j since manufacturers can use resale price maintenance. Then retailers simultaneously accept or reject the offers that are public information. If one offer is rejected, all contracts are refused. If all offers have been accepted, retailers simultaneously set their retail prices and demand and contracts are satisfied.

Let S_r define the set of products sold by the retailer r and S_f the set of products produced by the manufacturer f.

In the case of these two part tariffs contracts, the profit function of retailer r is

$$\Pi^r = \sum_{j \in S_r} [M(p_j - w_j - c_j)s_j(p) - F_j]$$

where c_j the constant marginal cost of distribution of product j and $s_j(p)$ the market share of the product j. The profit function of firm f is equal to

$$\Pi^f = \sum_{k \in S_f} [M(w_k - \mu_k)s_k(p) + F_k]$$

where μ_k represents the constant marginal cost of production of product j. Manufacturer f chooses the terms of the contracts (p_j, w_j and F_j) in order to maximize profits Π^f subject to the following retailers' participation constraints for all $r = 1, .., R$, $\Pi^r \geq \overline{\Pi}^r$.

If we consider the case where wholesale prices are such that the retailers add only retail costs to the wholesale prices and thus the retailer's price cost margins are zero ($p_k^*(w_k^*) - w_k^* - c_k = 0$), we deduce from this model, an expression for the price-cost margins of the manufacturer f :

$$\sum_{k \in S_f} (p_k - \mu_k - c_k)\frac{\partial s_k(p)}{\partial p_j} + s_j(p) + \sum_{k \in \{J',..,J\}} (p_k - \mu_k - c_k)\frac{\partial s_k(p)}{\partial p_j} = 0 \quad \text{for all } j \in G_f \tag{3}$$

where products in $\{J', .., J\}$ are private labels.[2]

[2] For expressions for private labels margins see in Bonnet and Dubois (2010).

Given the vertical supply model assumptions a price cost margin is obtained $\Gamma_{jt} = p_{jt} - \mu_j - c_j$ for the product j and a corresponding marginal cost $C_{jt} = \mu_j + c_j = p_{jt} - \Gamma_{jt}$ follows.

4.2 Cost Shock Simulation

Given these marginal costs $C_t = (C_{1t}, ..., C_{Jt})$ and the other estimated structural parameters, we are able to simulate an upstream cost shock λ and equilibrium prices are deduced from the following minimization program

$$\min_{\{p_{jt}^*\}_{j=1,..,J}} \|p_t^* - \Gamma_t(p_t^*) - \lambda \times C_t\|$$

where $\|.\|$ is a norm of $\mathbb{R}^J$. In practice we will take the Euclidean norm in $\mathbb{R}^J$.

The cost pass-through is estimated from the difference between observed prices and new equilibrium prices in the case of a cost shock. We investigate the asymmetry of cost pass-through simulating both a cost increase (for instance, $\lambda = 1.1$) and a cost decrease of the same magnitude (for instance, $\lambda = 0.9$) and comparing the magnitude of the price-cost pass-through for both the negative and the positive cost shock, where price-cost pass-through is defined as the ratio between the price change and the cost change.[3] The same counterfactual comparative statics simulations are performed for the estimated demand model allowing for demand asymmetries and then also for an alternative counterfactual demand model without asymmetries. We turn to the demand, costs, and finally to simulated results next.

5 Demand Asymmetry Results and Cost Pass-Through Simulations

In this section, we first present results from the estimation of consumers demand to assess asymmetric consumer price response to an increase or decrease in retail

[3] It has to be noted that equilibrium prices depend only on total marginal cost. Thus, the effect of production or distribution cost shocks that result in the same total marginal cost will always be the same.

prices. Then, we show how cost pass-through could differ in magnitude according to the sign of the change in cost via counterfactual simulations allowing for demand asymmetries, and then repeating those simulations for a counterfactual demand scenario without asymmetries.

5.1 Demand - Investigating Asymmetries in Consumer Price Responses

Table 4 shows the estimated instrumental variable demand parameters given a random coefficient specification under two model assumptions. Model 1 does not take into account the different consumer price response when prices increased or decreased whereas the model 2 does. Independent variables are listed in row and the marginal utility estimates are reported for each variable in row, while standard errors are reported in parentheses. Given that price is correlated with determinants of demand, we use instrumental variables and thus the reported point estimate associated with price is the IV estimate. According to the GMM objective function, the set of instruments used is valid since the test statistic of the Hansen (1982) test, the GMM objective, is lower than the critical value the a Chi-square with 7 degrees of freedom. Moreover, and although not reported, the price coefficient increases in absolute value relative to the OLS point estimate, which means that the instruments are estimating a marginal utility of price that suffers from less of an endogeneity bias towards zero, inherent to the OLS point estimate.

Model 1 does not consider asymmetric price responses and implies an average marginal utility of price of -0.74 with the correct sign and significant. The random coefficient of price is 0.16 and significant, implying that there is unobserved heterogeneity in price sensitivities in the data. Consumers seem to prefer Arabica to other coffee characteristics available and the point estimates would suggest that consumers do not like products with high promotional rates. When we now allow, as in Model 2, consumers to respond differently to price increases, while once again Model 2 exhibits a negative estimated average price coefficient of -0.73, when consumers

TAB. 4 – **Demand Estimates (standard errors are in parenthesis).**

	Model 1 Mean (Std)	**Model 2** Mean (Std)
Price (α^1)	-0.74 (0.02)	-0.73 (0.03)
Price$\times 1_{[p_t - p_{t-1} > 0]}(\alpha^2)$		0.12 (0.06)
Price (σ)	0.16 (0.08)	0.18 (0.09)
Promotion rate	-0.24 (0.07)	0.43 (0.35)
Arabica coffee rate	2.63 (0.25)	1.64 (0.56)
Robusta coffee rate	-0.38 (0.11)	0.15 (0.30)
Bean coffee rate	-1.52 (0.25)	-2.09 (0.40)
Caffeine-free coffee rate	-0.27 (0.16)	-1.08 (0.43)
$\delta_j, \eta_{y(t)}$ and $\eta_{m(t)}$ not shown		
GMM objective (*df*)	3.67($\chi^2(7)$)	2.25($\chi^2(7)$)

are faced with a price increase, their price marginal utility significantly decreases by 0.12. There continues to be significant heterogeneity in marginal utility of price, as the point estimate is 0.18 and significant. While promotional rates had a negative marginal utility in Model 1, when we do account for asymmetric consumer price responses then the promotional rate's marginal utility becomes positive and non-significant. Consumers continue to prefer Arabica to other characteristics as the coefficient related to the Arabica coffee rate is positive and significant.

In general, the random coefficients logit model allows for flexible price elasticities along the demand curve, which is an attractive feature relative to other demand specifications - such as constant elasticity. For instance, for Model 1, which is a standard random coefficients demand model, we obtain significantly different own price elasticities when prices increase and when prices decrease. The first column of Table 5 reports elasticities for model 1 and price increases and the second column for model 1 and price decreases. Then column 3 and 4 repeats the same structure of elasticity estimates for model 2. Finally, the elasticities are broken down by brands in each row of Table 5 where the first row of the table reports average own price elasticities across all brands. We obtain -4.58 (1.01) and -3.65 (0.65) for own price elasticities when prices increase in models 1 and 2 respectively, and -4.36 (1.00) and -4.20 (0.91)

TAB. 5 – **Own price elasticities from the Random Coefficients logit Model (standard errors are in parenthesis).**

	Model 1		Model 2	
	$\Delta p > 0$	$\Delta p \leq 0$	$\Delta p > 0$	$\Delta p \leq 0$
Average over Brands	-4.58 (1.01)	-4.36 (1.00)	-3.65 (0.65)	-4.20 (0.91)
Brand 1	-5.96 (0.38)	-5.77 (0.33)	-4.40 (0.26)	-5.48 (0.31)
Brand 2	-3.95 (0.43)	-3.58 (0.43)	-3.10 (0.31)	-3.49 (0.40)
Brand 3	-5.08 (0.50)	-4.61 (0.55)	-3.87(0.34)	-4.44 (0.50)
Brand 4	-5.07 (0.73)	-4.66 (0.74)	-3.85 (0.46)	-4.48 (0.68)
Brand 5	-3.83 (0.80)	-3.24 (0.57)	-3.01 (0.57)	-3.17 (0.55)
Brand 6	-5.58 (0.49)	-5.07 (0.62)	-4.18 (0.32)	-4.86 (0.56)
Brand 7	-3.90 (0.39)	-3.66 (0.40)	-3.06 (0.28)	-3.57 (0.38)

for models 1 and 2 respectively, when prices decrease. While estimated own price elasticities seem to be fairly similar when consumers face a price decrease, we obtain a significant difference in estimated implied elasticities when prices increase when comparing model 1 to model 2. In particular, if we do not account for asymmetric price responses, as in model 1, we over estimate consumer price response by 30% in average when they face a price increase. Breaking up the comparison by brand, looking down on Table 5, we also see that own price elasticities are different across brands and that the over estimation of own price elasticities could vary from 27% to 35%, according the brand in question, if we do not consider demand asymmetries.

In sum, the estimates suggest there to be significant price sensitivity heterogeneity in the data as well as asymmetries in the way consumers respond to price changes depending on them being price drops or price increases. Moreover, not accounting for those asymmetries would imply that we overestimate demand elasticities in the case of price increases. What these demand empirical findings imply for the recovered marginal cost estimates and for the ability of firms to pass through positive and negative costs shocks into retail prices will be investigated next.

5.2 Cost Pass-Through Counterfactual Simulations

From the demand model estimates, we are able to compute estimated margins from the supply model in section 4.1. We obtain in average 35.08% with a standard

TAB. 6 – **OLS regression of the marginal cost estimated.**

Marginal cost estimated	Model 1 Mean (Std)	Model 2 Mean (Std)
Raw	0.052 (0.001)	0.048 (0.001)
Product fixed effects	Yes	Yes
Time fixed effects	Yes	Yes
R^2	0.96	0.96
Number of observations	5671	5671

deviation 7.90. Taking the difference between observed prices and estimated margins, we can estimate marginal cost for each product at each period in our French Coffee data which amounts to €4.61 (1.61 for standard deviation).[4]

Given the estimated models, we simulate a range of negative and positive shocks (between -100% and 100%) to obtain a distribution of cost pass-through estimates. The first step is to estimate the impact of the cost shock on the total marginal cost of coffee products. We use an OLS regression of the marginal cost estimated from the demand and supply models on the raw coffee price and product and time fixed effects and the results are given in Table 6. Marginal cost changes correspond to 84% of the simulated raw cost shock, that is when the raw coffee shock increases by 10%, the impact of the total marginal cost is by 8.4%, and that is true for the marginal cost estimated from both demand models.

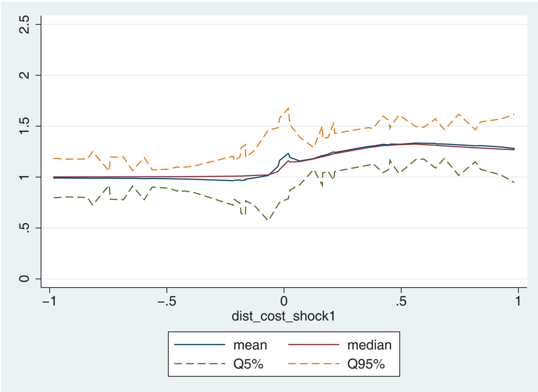
Recall that the estimated price-cost pass-through is defined by the ratio of the difference in final retail price and the difference in raw coffee cost shock. Given estimates of demand allowing for demand asymmetries, as given by model 2, Figure B depicts estimated average price-cost pass-through and 95% confidence intervals in the vertical axis. In the horizontal axis we report different levels of simulated shocks, from -100% to 100%. Similarly, in Figure A we report the simulated average price-cost pass-through and 95% confidence intervals in the y-axis, for the different levels of simulated shocks in the horizontal axis, for a counterfactual demand model of no

[4]In the model 1 case, that is without considering asymmetric consumer price response, margins are underestimated, 30.21 (7.29) on average, and marginal costs are then overestimated. Indeed we obtain 4.95 (1.73) on average, which consists in an error of estimation by 7% in average.

demand asymmetries (where $\alpha^2 = 0$ in (1)).

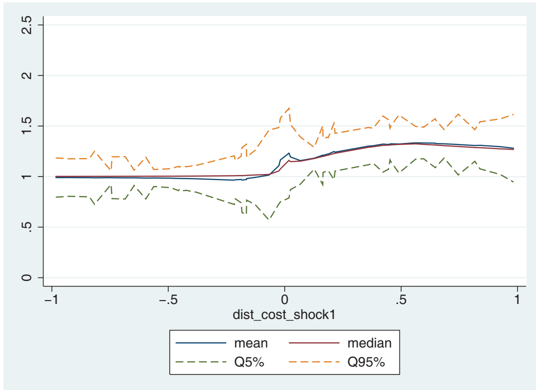
Figure B suggests that a positive raw coffee shock is more passed onto retail prices than a negative raw coffee shock when considering asymmetric price response. We also obtain that the pass-through tends to decrease after a positive cost shock greater than 50%. Small negative cost shocks are slightly transmitted more than 1 whereas after a negative 10% cost shock, the pass-through seems to converge to one.

Figure A



Price-cost pass-through
without asymmetric consumer price response

Figure B



Price-cost pass-through
with asymmetric consumer price response

When asymmetric consumer price response is not considered, turning now to Figure A, we can see that few differences exist between the effect of a positive and of a negative cost shock on retail prices. Both imply a pass-through around 1, even if a positive cost shock slightly implies a pass-through above one and a negative cost shock below one.

Table 7 shows the results from a second stage regression of estimated pass-through rates on cost shock variables and on product characteristics when we take into account the asymmetric price response of consumers in the demand model. We project the estimated pass-through rates into average pass-through for each retailer (given by dummy variable point estimates for each retailer separately relative to retailer 7, that is omitted). The estimated dummies capture the different average price transmission rates of retailers. We do the same by projecting estimated pass-through on a dummy for each of the three manufacturers and for the private labels. Finally we also project estimated pass through on negative cost shocks and positive

TAB. 7 – **Regression of Pass-through on cost shock variables and product characteristics.**

	With asymmetric consumer price response
Retailer 1	-0.002 (0.001)
Retailer 2	0.000 (0.001)
Retailer 3	0.002 (0.001)*
Retailer 4	0.006 (0.001)**
Retailer 5	0.001 (0.001)
Retailer 6	0.003 (0.001)**
Manufacturer 1^+	0.163 (0.002)**
Manufacturer 1^-	-0.047 (0.001)**
Manufacturer 2^+	0.081 (0.002)**
Manufacturer 2^-	0.010 (0.002)**
Manufacturer 3^+	0.045 (0.002)**
Manufacturer 3^-	-
Private labels$^+$	0.077 (0.002)**
Private labels$^-$	0.013 (0.002)**
Cost variation$^+$	0.233 (0.003)**
Cost variation$^-$	-0.245 (0.003)**
Cost variation$(> 50\%)^+$	-0.123 (0.003)**
Cost variation$(>50\%)^-$	0.132 (0.003)**
Constant	1.073 (0.004)**
Month fixed effects	Yes

*significant at 10%, ** significant at 5%

cost shocks, where we include as explanatory variables the value of the cost shock, differentiating between negative and positive shocks, and allowing for different effects whether the cost shock is greater than 50%. Finally, we control for the time period as well in the regression specification.

We find very small differences across retailers. While very few of the retailer fixed effects are significant, their value is economically low. Concerning manufacturers specific pass-through given by the manufacturer estimated fixed effects, we see larger and more significant manufacturer differences. This implies that the role of manufacturers in the price transmission of cost shock is greater than the role of retailers. While this result could be seen as a consequence of the supply model assumed, we argue next that is not the case. Indeed, we consider that manufacturers have all bargaining power and they impose to retailers the consumer prices. However, Rey and Vergé (2010) show the price equilibrium would be the same whether one assumed that retailers have all the bargaining power. Only the sharing of the profit would change. The estimated marginal cost and then the estimated pass-through rates would be the same. Hence, this result is not an artifact of this assumption.

In sum, there is heterogeneity across manufacturers in the price transmission of a cost shock. We also see that private labels transmit more negative shocks than the three other manufacturers whereas their price transmission of a positive cost shock is significantly lower than manufacturers 1 and 2. Results from cost shock variables show that the pass-through from a positive cost shock increases with the level of the shock whereas we find the opposite result for negative cost shocks. We also find that large positive cost shocks (greater than 50%) are less transmitted and large negative cost shocks are more transmitted. Taken as a whole, we see that cost shocks are more transmitted to the consumer price than the variation in cost and positive cost shocks are more transmitted than negative ones as we saw in the graphical analysis and discussion as well.

6 Conclusion

In this paper, we present empirical evidence on the role of possible asymmetries in consumers' price responses into explaining asymmetric cost price pass-through into retail prices. For that, we use a structural econometric model that allows to recover marginal costs from prices, market shares and product characteristics. Given the demand and supply model we estimate marginal cost. From estimated cost we simulate shocks and find the resulting simulated new equilibrium prices.

Introducing the possibility of consumers reacting differently to a price increase or decrease, we find that French households are less sensitive to a price increase than to a price decrease on the Coffee Market. Our findings suggest that one would overstate elasticities for price increases by about 30% if not considering demand asymmetries. Ultimately these findings imply different magnitudes of a cost pass-through into retail prices, depending on the sign of the cost shock. In particular, we find that allowing there to be demand asymmetries, a positive cost shock is passed through to a larger degree into retail prices than a negative cost shock of the same magnitude.

Our findings imply that the shape of the demand explains observed asymmetric price transmission of cost shocks in the context of imperfectly competitive markets. Future work could consider varying the competitive structure of the empirical setting by looking into other market settings. Another possible avenue of research is to consider dynamics into the analysis, both on the demand, and on the supply side, while incorporating formally menu costs of changing prices into the model. As these models become quite complicated to solve analytically and computationally intensive we see this research extension efforts as potential next steps into understanding the magnitude and the asymmetry of price-cost pass-through in the markets.

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