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Incomplete cost pass-through under deep habits ☆

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ABSTRACT

A number of empirical studies document that marginal cost shocks are not fully passed through to prices at the firm level and that prices are substantially less volatile than costs. We show that in the relative-deep-habits model of Ravn, Schmitt-Grohé, and Uribe [Ravn, M., Schmitt-Grohé, S., Uribe, M., 2006. Deep habits. Review of Economic Studies 73, 195–218], firm-specific marginal cost shocks are not fully passed through to product prices. That is, in response to a firm-specific increase in marginal costs, prices rise, but by less than marginal costs leading to a decline in the firm-specific markup of prices over marginal costs. Pass-through is predicted to be even lower when shocks to marginal costs are anticipated by firms. In our model unanticipated firm-specific cost shocks lead to incomplete pass-through (or a decline in markups) of about 20 percent and anticipated cost shocks are associated with incomplete pass-through of about 50 percent. The model predicts that cost pass-through is increasing in the persistence of marginal cost shocks and U-shaped in the strength of habits. The relative-deep-habits model implies that conditional on marginal cost disturbances, prices are less volatile than marginal costs.

1. Introduction

A number of empirical studies document that marginal cost shocks are not fully passed through to prices at the firm level. The observed sluggish response of prices to cost disturbances is also reflected in prices being substantially less volatile than costs. See, for instance, Goldberg (1995) for the automobile industry, Kadiyali (1997) for the photographic film industry, Hellerstein (2004) for the beer industry, and Nakamura (2006) for the coffee industry.

This paper develops a theoretical explanation for the observed incomplete pass-through of marginal cost disturbances to prices. The central element of our proposed theory is habit formation at the level of individual goods. In particular, we adopt the model of external relative deep habits due to Ravn et al. (2006). When habits are formed on a good-by-good basis, the demand function for an individual good depends not only upon its relative price but also on past consumption of that good. This is because demand depends positively on the stock of habit, and the stock of habit, in turn, is an increasing function of past consumptions.

There is vast empirical support for working with preferences that give rise to a link between current and past demand. Houthakker and Taylor (1970) study goods level demand functions and identify past sales as a central determinant of current consumption of goods at the disaggregated level. In a seminal study of scanner data, Guadagni and Little (1983) document

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a large predictive power of past brand choices on current brand choices (commonly referred to as state dependence) in an application to ground coffee purchases. While econometric methods have developed over time, these findings have been reproduced by many researchers (Chintagunta et al., 2001, discuss some of the econometric issues related to the estimation of such state dependence).[1] Browning and Collado (2007) instead study goods levels consumption demand functions controlling both for unobserved consumer heterogeneity and for goods-level habits. They find that there is a substantial number of goods for which there are habits at the goods-level. Our contribution is to analyze how such features affect firms' incentives to pass on marginal cost shocks into prices.

A consequence of allowing for good-specific habit formation is that the profit maximization problem of the firm becomes dynamic. For higher current sales generate revenue not only in the current period but also in future periods by raising future habitual demand. Firms take this intertemporal connection of revenues into account in their price setting decision. In Ravn et al. (2006) we explore the consequences of preference specifications featuring deep habits for the transmission of aggregate shocks in general equilibrium. The aim of the current paper is instead to examine how idiosyncratic marginal cost shocks affect the pricing policy of individual firms producing differentiated goods, thus linking up more closely with the empirical literature on cost pass-through. This emphasis makes the current paper relevant for interpreting microeconometric studies of the effects of cost changes on markups. The main theoretical gap in the existing empirical literature is the pervasive use of static demand systems (or sometimes non-micro-founded, dynamic systems based on the ad-hoc addition of lags). Our study sheds light on these issues by placing at center stage intertemporal tradeoffs in determining the degree of pass through of shocks affecting the firm's cost structure. We show that neglecting these intertemporal channels might introduce significant biases in the estimated size of pass through. We therefore see the contribution of the current paper as a potential guide for empirical work on pass through.

We demonstrate that in the relative deep-habit model cost pass-through is incomplete. In particular, we show that a temporary increase in marginal costs induces firms to increase prices less than proportionally resulting in lowered markups. Firms find it optimal to narrow profit margins in the current period to limit the decline in future habitual demand triggered by the price increase. It follows that firms pass on only a fraction of the increase in marginal costs they experience. Our emphasis on desired markup adjustments in explaining incomplete cost pass-through is in line with the available empirical evidence. Hellerstein (2004), for instance, finds that 68 percent of incomplete cost pass-through in the beer industry is explained by desired markup adjustments. Nakamura (2006) attributes a smaller but still sizable role to desired markup adjustments in explaining the response of prices to marginal cost shocks in the coffee industry.

Our relative deep-habit model predicts that pass-through increases with the persistence of marginal cost shocks. The reason is that when the cost increase is more persistent, it is less valuable for the firm to maintain the size of its customer base, as production conditions are expected to be unfavorable for a number of periods. A consequence of the positive relationship between pass-through and the persistence of cost shocks is that the ratio of price volatility to marginal-cost volatility also increases with the persistence of cost shocks.

The deep-habit model further predicts that anticipation of marginal cost disturbances exacerbates incomplete pass-through. The reason is that when firms learn about a future cost increase they find it optimal to gradually adjust prices upward as a way to disinvest in customer base. Consequently, the required increase in prices at the time the shock is actually realized is smaller than it would have been had the shock been unanticipated. This finding suggests that structural econometric estimations of incomplete cost pass-through should attempt to distinguish between the pass through of anticipated and unanticipated cost shocks. For failing to do so may result in an overestimation of the incompleteness of pass through.

The deep habits mechanism that we study is related to a number of existing studies that share as the central transmission mechanism a demand function that depends proportionally on a measure of past sales. Phelps and Winter (1970) develop a model of customer markets, by assuming that current demand is proportional to the firm's market share in the previous period. Klemperer (1987, 1995), Froot and Klemperer (1989), and Kleshchelski and Vincent (2007) assume that customers face a fixed cost of switching suppliers. Thus, the current propensity to consume a particular good depends in part on past consumption of that good. Of these papers, the one most closely related to our study is Kleshchelski and Vincent (2007), as it focuses on the effects of firm-specific marginal cost shocks. An important difference between switching cost models and our deep-habit formulation is that in the deep habit model there is gradual substitution between differentiated goods, rather than discrete switches among suppliers. One advantage of this, from the point of view of analytical tractability, is that under the deep-habit formulation one does not face an aggregation problem. Buyers can distribute their purchases identically and still suppliers face a gradual loss of customers if they raise their relative prices.

In their seminal contribution, Froot and Klemperer (1989) conjecture that quite generally any model in which lagged sales increase current demand will imply incomplete pass through of marginal cost shocks. We establish in this paper that in order for this conjecture to hold, it is critical that past sales (or a function thereof) enter the demand function in a multiplicative fashion. In fact, we show that if past sales enter the demand function in an additive rather than multiplicative fashion, the model no longer predicts incomplete pass-through.

[1] A partial list of recent papers that have documented a link between current and past brand choices includes: Roy et al. (1996) for catsup brand choices; Keane (1997) for ketchup brand choices; Goldfarb (2006) for consumer purchases at an Internet portal; Zhang and Krishna (2007) for an on-line retailer; Bell et al. (1999) and Seetharaman et al. (1999) for a wide selection of goods.