RESEARCH PAPERS

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Research Paper no. 2/01

Price stickiness and consumption hedging

Sven R. Larson

Roskilde University, Denmark

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Research Papers from the Department of Social Sciences, Roskilde University, Denmark.

Working paper series

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Abstract

Recent empirical contributions to price theory show that prices are sticky to a much larger extent than economic theory generally acknowledges. This paper places research on sticky prices in a theoretical context of uncertainty and suggests that panel data be used to a larger extent in studies of the role of sticky prices in the economic system. The argument is that panel data more accurately can reveal how economic agents use sticky prices to manage their private cash flows in a world of uncertainty. It is suggested that the best way to use panel data is to set up two panels, one of prices and one of economic agents, and that these panels are then matched against each other.

Keywords: Prices, price, stickiness, propensity to consume, uncertainty.

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Price stickiness and consumption hedging

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TABLE OF CONTENTS

Introduction

Traditional price theory proposes that prices are set according to the principles of auction markets and that they are flexible, free to move, from one period to the next. Recent evidence speaks a different language, whether theoretical (Okun 1981; Hicks 1989; Larson 2000) or empirical (Kahneman et al. 1986; Blinder 1991; Carlton 1991; Campbell & Kamlani 1997; Bewley 1999; Larson 2000, ch. 1; for a comprehensive overview, see Lee 1998). The message from these studies, in particular the empirical ones, is that consumers as well as producers have a strong interest in a mode of pricing that differs radically from the propositions of traditional price theory. Larson's theoretical contribution shows that consumers become more confident and therefore *better off* the longer prices stay unchanged. Bewley (1999, chs. 3, 11, 12) finds that frequent changes in the price of labor, the money wage, do antagonize workers; it is very reasonable to draw the conclusion from Bewley's results that workers express feelings of antagonization because unexpected wage changes make them more uncertain and therefore *worse off*.

Acknowledging these findings, this paper paves the way for a broader contribution the ambition of which it is to make three distinct contributions: 1) to show how consumers' satisfaction with price stickiness can be measured; 2) to give an example of how more detailed evidence could be obtained to show that consumers are indeed satisfied with price stickiness – that, in other words, store level sticky prices are both present and useful; and 3) to suggest an institutional innovation on markets with high price turnover and volatility[1], the purpose of which will be to provide consumers with a hedging instrument against both high turnover and high volatility.

This paper is limited to presenting the first of these three contributions. Section 1 gives a theoretical and methodological background of the three contributions. Section 2 discusses the method for obtaining empirical evidence on the presence and usefulness of price stickers with concentration on advantages and disadvantages of cross-section and panel data.

The preliminary nature of this paper implies that more is to come. A third section will be added to present empirical results that describe price stickiness on the store level of the economic system, as part of the fully expanded paper's second contribution. These results will be introduced in two steps: the first step will verify or falsify the proposition that consumers find price stickers useful; the second step will seek evidence on how price stickiness affects consumer behavior – i.e. possible micro- and macroeconomic ramifications of price stickiness.

As a completion of the fully extended paper there will suggested a development of pricing institutions on markets where prices are relatively flexible. A consumption hedge instrument will be introduced; the purpose of this instrument is to allow consumers to hedge against future price fluctuations. This hedging resembles – but does not copy – the hedging practice found in use of derivative instruments on financial markets and markets for raw materials, such as oil. The consumption hedge instrument, which for sake of brevity from hereon is referred to as the *C*-

[1] We use "price turnover" to refer to the frequency by which prices are changed, while "price volatility" refers to the variance of nominal price changes. This distinction will become meaningful as we proceed.

hedge,[2] provides the average consumer with a hitherto non-existent opportunity to insure both against inflation and against price turnover – given that turnover can escalate into price volatility.

Price studies – a background

Sticky prices are – at least broadly speaking – approached in two different ways in economic literature: one that says that *prices do what prices are*, and another according to which *prices are what prices do*. The first approach is definitional: its point of departure is in what sticky prices are – a definition of price stickiness, for short. Having clarified what a sticky price is, the definitional approach explains what sticky prices do by entering them into, e.g., macroeconomic systems. Since this means entering them into existing systems, the procedure means replacing an old definition with a new one. The new definition – and its consequences for what sticky prices do – will then make *the* difference to the macroeconomic system and any analysis based on it.

The second approach is performance oriented and is primarily – but not exclusively – used in Post Keynesian literature. Unlike its definitional counterpart the performance approach to sticky prices begins with an explanation of what sticky prices *do*, not of what they *are*: a sticky price carries nominal value from one period to the next. Price stickiness is then defined as being a value carrier, and the results of inserting a performance-approached sticky price into a macroeconomic system are clearly different from the results of using the definitional approach.

This paper is empirical and will therefore downplay the importance of theory behind the two approaches. It is important, however, to place empirical research on sticky prices in a theoretical context, in order to understand the relevance of asking why prices are sticky and what studies of price stickiness can lead to.

The definitional approach to price stickiness has been used primarily to explain deviations freom full employment general equilibrium in macroeconomics – an overview is in Okun (1982, ch. 1), and Mankiw & Romer (1991) contains several good contributions in the same direction. One of these contributions, by Blanchard (1991), uses sticky prices to explain deviations of production and employment from long-run equilibrium; the difference between full employment and unemployment is exclusively explained by the absence and presence of sticky prices, respectively. A price that does not change from one period to the next despite pressure from a changing supply-demand balance does, according to Blanchard, explain why the economic system performs worse than its potential allows it to.

An earlier example of a definitional approach to sticky prices is that of Barro & Grossman (1971). Taking sticky prices as given they develop a general disequilibrium model where deviations from full employment are possible in a way they cannot be under flexible prices. While the results are theoretically significant, it is a problem that the presence of sticky prices is unexplained Prices are set by economic agents who, it is reasonable to assume, are aware – at least as a collective – of any profoundly negative consequences of sticky prices. Therefore it is

[2] The term "C-Hedge" was used in a brief definition of this product in Larson (2000, sect. 2.2).

problematic to leave the presence of price stickiness unexplained. This problem is common to definitional approaches and emanates from their emphasis on what sticky prices are – their definition – rather than on what sticky prices do – their performance.

A performance approach can be explained in terms of a dual decision situation. Traditionally, a dual-decision situation is one where prices are normally thought to be flexible but quantities stay rigid (Clower 1964; Leijonhufvud 1969; for a brief reference, see Hahn 1984). We acknowledge that quantities are sticky, but we add that a necessary condition for successful dual decision-making is that a sufficiently large number of prices (money product prices and money wages) *are made sticky* by the economic agents. The price stickers are, in other words, given an assignment to perform in a certain way in the economic system. In their dual decision situation economic agents have to engage actively in cash flow management with the goal for the individual economic agent being to balance cash inflows against cash outflows over time. A sticky price – a price sticker, to be precise – carries a nominal value anywhere and for as long as it is recognized by buyers and sellers. Therefore it is, under given conditions, a formidable tool for value preservation in dual decision situations where two values have to be decided more or less simultaneously. By allowing an economic agent to determine the money value of one price the price sticker reduces the delicate complexity of the dual decision situation. Since the duality of the situation is the key problem facing the decision maker, parallel contracting of cash flows – i.e. of money prices – is the economic agent's ideal solution to a problem where she otherwise is genuinely uncertain as to her ability to match incoming cash with outgoing cash:

> So long as [the economic agent] cannot predict the price of the labor she sells, she is still unable to avail herself of the forward prices in any meaningful way. Uncertainty management bears fruit if and only if the economic agent successfully handles her dual decision situation – as both consumer and producer – and this success is granted if and only if she can obtain parallel contracting of wage and prices. (Larson 2000, p. 55)

Being aware of the positive pay-off from parallel contracting, economic agents express a preference for sticky prices. A sticky price is wanted, for short, because it helps the individual consumer or producer solve the dual decision problem – and it provides its solution by carrying nominal value from one market to the next, from one period of time to the next.

Each price contract sends a ray of predictability into the future: once agreed to, a money price contracted for tomorrow will stand as a point of reference today to all other activities that the individual economic agent is engaged in here and now. The first and foremost purpose of price contracts – where explicitly written or implicitly represented by price stickers on the milk shelf in the supermarket – is to carry predictability through space and time.

This is, essentially, the performance approach to price stickiness. Prior to Larson, Okun (1982) gives a predictability based performance explanation of what sticky prices do:

> Customers are valuable to sellers because of their potential for repeat business. That process of repetition makes the current level of demand experienced by a firm depend positively upon its volume of sales in the past. The extent to which firms are likely to enjoy repeat patronage depends both on the satisfaction of cunstomers with previous purchases and their confidence that the supplier will maintain good performance. (Okun 1982, p. 141)

The term "good performance" is clarified:

> The firm comes to recognize its ability to discourage customers from shopping elsewhere by convincing them of the continuity of the firm's policy on pricing, services and the like. It knows that its customers have indicated by their previous purchases that they regarded the firm's offers as satisfactory. It can encourage them to return to buy, or at least to shop, by pledging continuity of that offer, ensuring them that past experience will be a reliable guide to present and future offerings. *The firm wants to promote a reliance on intertemporal comparison shopping.* (Okun 1982, p. 141; emphasis added.)

Firms are interested in stabilizing demand – and thereby cash inflow – over time. Consumers are, says Okun, attracted to continuity (meaning among other things sticky prices) for a different reason: repetition of historically successful trade helps them minimize search costs. The motive of the seller to keep prices sticky is not necessarily the same as the motive of the consumer; it makes sense to read Larson's explanation – that sticky prices help reducing uncertainty to both buyers and sellers – as an amendment to Okun's argument. The consumer's desire to reduce search costs and the firm's preference for continuity in revenues may very well both be driven by the knowledge that absence of a device to carry money value from one period to the next, from one market to the next, has to be countered with strong efforts to establish predictability in prices – and in revenues. These efforts, in the form of time and of money, could otherwise have been used to consume and produce.

In another contribution that must be said to fall within the performance approach, Hicks (1989) starts from a different angle. The problem in price theory, he says, begins with the marginalist revolution when attention was shifted from natural prices to market prices:

> The chief thing which happened at the 'marginal revolution' of Jevons and his contemporaries was a shift of attention to market values. They were determined, it was accepted, by supply and demand; but how? Just how did the market work? (Hicks 1989, p. 7)

Being unsatisfied with the fact that the marginalist explanation – both in Jevons's form and in the Walrasian iteration – always claims the market was in equilibrium, Hicks seeks an answer that allow markets to function without being trapped in an equilibrium price conversion process. The marginalist emphasis on equilibrium prohibited out-of-equilibrium trading, possibly with the exception of small, insiginificant "false" trade; if trade was not allowed outside equilibrium, and if equilibrium only came about through a process of market making, then the products traded had to be perishables. Carry-over supply would mean continuity of the market and call for explanations of storage, inter-period pricing and intertemporal preferences (such as speculation) that were serious enough to encourage search for a different explanation of prices:

> The right thing, surely, would have been to go on to construct a formal theory of the market for anon-perishable product; that indeed would have turned a corner [of price theory]. One

> could still have followed Marshall and admitted intermediary traders; and also have followed him in supposing that these were the people who held the stocks. (Hicks 1989, p. 10)

But this did not happen. One reason, says Hicks, was that the market would become a speculative one: with the price set anew every day those who carried stocks into the future would be speculating in where the market price were going. Another reason was that the theory...

> that was needed could not be developed without a considerable change in point of view. The traditional view that market price is, at least in some way, determined by an equation of demand and supply had now to be given up. (Hicks 1989, p. 11)

The stockholder has different preferences and seeks a price for her holdings based on conditions that are clearly different from the conditions upon which new production is brought to the market. Therefore, Hicks sees the need for a new theory.

In Hicks's argument, price stickers enable the wholesaler to intermediate on the market: the wholesaler can buy from the producer knowing with good approximation the price she will be able to charge the final consumer. She can store the product for as long as is technically and financially possible, and rely on the price sticker to carry the nominal value of the product (including her mark-up) through time. By enabling the wholesaler to enter the market the price sticker does in fact pave the way for the non-perishable goods market itself.
Hicks takes a performance approach to sticky prices, arguing that the market itself would be non-existent if the sticky price was non-existent. Okun's approach is similar in kind, concentrating on the consumer's interest in waiving search costs and on the producer's interest in establishing a steady stream of revenues. Larson adds an explicit preference for predictability that leads both consumers and producers into explicitly preferring sticky prices to flexible prices.

With this theoretical background in mind we proceed to our empirical investigation of price stickiness and its usefulness to economic agents. Placing our point of departure in the performance approach, we begin with an elaboration on how price stickiness and the usefulness of the price sticker can be measured.

The practice of price-uncertainty studies

This section defines the two key concepts of the study: *price stickiness* and the *usefulness* of sticky prices. Definitions are sought not only for reasons of usual conceptual clarification the purpose is also to pave the way for an empirical study of price stickiness and its usefulness to economic agents.

Price stickiness, to start with, is defined in two dimensions, which we will refer to as "volatility" and "turnover". The first dimension, volatility, is spatial, meaning simply the variance in the value of a money price. The second dimension, turnover is temporal and refers to the *rate of change* in a product's price. Based on this dimensional dichotomy we can reach a definition of price stickiness which says that a price is sticky when its volatility and turnover are both at what we can preliminarily refer to as acceptably low levels. It is only possible to give concrete, quantitative meaning to "acceptably low" empirically, through studies of consumers' and sellers' preferences for – or against – volatility and turnover. Until such empirical facts are established it is sufficient that we speak of "acceptably low" volatility and turnover.

Both dimensions are equally important in our definition of price stickiness. It does not make sense to speak of a price as sticky when price changes seldom take place but, when they do, they are extremely violent; extremely violent changes in a money price inject uncertainty into the short-term outlooks of consumers and producers. It is similarly unreasonable say that a price is sticky when it fluctuates frequently, even if fluctuations are within a relatively narrow bracket. When price stickers are carriers of nominal value through time and space, the value they carry has to stay unchanged during transportation: too frequent or too violent changes derail the value carrier and so the purpose of establishing a sticky price is lost.

Having established a definition of price stickiness our next step is to outline how this definition can be transformed for measurement purposes. In compliance with the two-dimensional definition of price stickiness we outline a method for measurement which is also two-fold, accounting for volatility and turnover independently. As to volatility we measure, for obvious reasons, the variance of a money price. Technically, measuring volatility as such is uncomplicated; measuring this dimension of price stickiness only becomes difficult when we want to put it in relation to the other dimension, turnover, which may be more difficult to measure already from the start:. while price levels as such can be observed both through data records and direct store level observations, the frequency of price changes will either require store level studies over time or obtainment of records on pricing history from price setters. The former method is the most accurate, and the fact that it is time consuming to employ should not discourage us from using it; panel data studies – the kind of studies we are in effect talking about – have already been produced in many different areas (Batalgi 1995, pp. 1-7; Goodin et al 1999, ch. 1) and the usefulness of the panel data method grows with its use.

With a definition of price stickiness in place, let us proceed to find a definition of and a way to measure the second concept, usefulness. The definition, to start with, is that a sticky price is useful when it encourages a majority of its regular users to

reduce their precautionary measures as compared to what of such measures they would have taken in absence of the sticky prices. If, in other words, a majority of consumers or producers who use the sticky price regularly do not benefit from it in terms of experiencing a lower level of uncertainty – experiencing a higher degree of confidence – as to their ability to cover future cash flows, then a sticky price is not useful.

It is more difficult to measure the usefulness of a sticky price than it is to measure price stickiness as such. The key term in our definition of usefulness is confidence. This variable is of the kind that are particularly difficult to quantify, and thereby measure in a traditional fashion. Much like the case with experiences of colors (Keynes 1973, p. 37) or of emotional states such as good morale (Larson 2000, ch. 3) or utility, the experience of confidence can be expressed as being more or less strong, but we cannot give quantity to how more or less strong our experience is. Yet, it is inevitable that we seek quantitative data on such variables in economic analysis, data that can be collected in tow different fashions: by means of traditional ex post observations, or by means of questions directed to economic agents.

Suppose we want to analyze the usefulness of price stickers to consumers over a given period of time. To use ex post data we obtain figures on relevant variables – such as price stickiness, consumer spending and precautionary saving – which is then treated in accordance with traditional methods for cross-section data. Hopefully our results correspond to adopted standards for significance, and normally those standards will be satisfying. But if the motives behind acts that cause a variable to fluctuate are closely related to a variable that is hard to quantify – such as confidence – the exact reaction pattern of sticky prices, consumer confidence and precautionary saving (its alleged expression) can still elude us. In order to detect the precise relationship between the variables by means of which we measure the usefulness of price stickers, we have to allow consumers themselves to express their reactions to the existence as well as to changes in price stickiness.

But it is not sufficient only to do surveys of consumer confidence; so long as we do not focus the direct relations between the price sticker – so long as we do not collect data from panels of prices and consumers – we risk having external variables exercising influence enough to distort our conclusions. This is a problem particularly in studies where the key variable is very hard to quantify because of its emotional nature. Moreover, since this is an emotional variable its quantity is decided strictly on the individual level. This is so for the same reason as our moral reactions, our preferences for colors, music or love are individual and cannot be argued rationally.

An alternative to use of cross-section data is, as mentioned, panel data. In our particular case we need a panel with consumers, but we also need a panel with prices. A price panel is necessary to establish two ends in the consumer's relation to the price sticker; a price panel consists of a set of prices of the products that the consumer buys regularly. Changes in this panel are then matched with changes in the consumer's confidence.

A two-panel study of this kind appears to provide us with an epistemologically ideal set of data, but we will have to account for four difficulties. First, it is not altogether obvious which prices should be enclosed in a panel; unless a consumer has very strict purchasing habits and always picks milk off the same shelf in the

same store every time, the price panel will have to contain a number of "neighbor" prices. A neighbor price is the price of a product, e.g. milk, at a store which the consumer does not frequent as often as her favorite store but which does provide viable competition. The difficulty lies in identifying neighbor prices. Suppose a consumer stops for groceries at PriceChopper on 63rd street for the majority of her weekly grocery shopping. This supermarket is conveniently located between her work and her home. Occasionally, however, she has to stop at Wahlgreen's pharmacy on 37th street, and since it would be a detour to stop by her 63rd street PriceChopper favorite supermarket she takes the opportunity to shop at D'Agostino's next to Wahlgreen's about once per week. Prices on most items are the same in both supermarkets, but the consumer occasionally notices some differences. If, e.g., beef is notably cheaper at D'Agostino's when she stops by there, she may pick up some extra and stuff it in the freezer.

In our study the prices of groceries at D'Agostino's would have to be enclosed as neighbor prices. The best way to decide which prices to take into account both as core prices and as neighbor prices, and also which ones to exclude, is to let every consumer in the consumer panel, as part of setting up the study, describe their regular shopping habits. This description is then followed up as consumers are asked on a regular basis where they actually shopped.

There is also a second difficulty to be accounted for. Every price included in the price panel does, technically speaking, represent an outlet spot: the place on a shelf where half-gallon skimmed milk by one particular milk producer can be picked up is a spot where that product is let out by the supermarket. While these outlets may remain unchanged geographically – remaining on the same shelf on the same isle in the supermarket throughout the whole period that our study runs – the quality of the product may change and thereby present the consumer with a new set of alternatives. Although this is no problem unique to a price panel study, it does present us with a definitional problem as we have to state under what circumstances an outlet spot is still the same even if the product changes significantly.

We have to take into account a third difficulty, namely the possibility of changes in the relation between the consumer and the stores or supermarkets where she shops. Particularly two changes are of relevance here: changes in payment forms and changes in conditions for travelling. A change in the payment form is a change in the technical conditions of paying (and therefore of shopping) that stems from technical innovation or a change in workplace routines. A good example of a change in the payment form is the introduction of credit cards: they have partly replaced cash and checks as forms of payment[3].

[3] 66.5% of all households in the United States had at least one bank-issued credit card in 1998 (Board of Governors of the Federal Reserve System 2000, p. 23). The increment in use of credit cards shows in the development of revolving consumer credit, which mostly consists of outstanding balances on credit card accounts: in 1980 revolving credit amounted to $55.1bn; in 1990 it had grown to $223.3bn, a rise by 405%. In 1998 it reached $558.5bn, having grown 250% in eight years (http://web.lexis-nexis.com/statuniv; table 824: "Consumer Credit Outstanding and Finance Rates 1980 to 1998"; as of July 2000). During the same two periods consumer expenses in the United States grew by 217% and 152.7%, respectively (http://www.stat-usa.gov; "GDP and Other Major NIPA Series, 1959-99"; as of July 2000). It is fair to assume that if stores and supermarkets differ in their credit card acceptance policy this may affect consumer shopping habits.

A change in conditions for travelling is a change that raises or lowers the barrier for a consumer to seek neighbor prices. Purchase of a car as well as costs of driving are relevant, but also establishment of new stores and supermarkets – as well as closing of old ones – obviously affect travel conditions. Other factors, such as price of gasoline and the cost and convenience of travelling by public transport, belong to the same category of variables.

Finally, a fourth difficulty is the relation between the scientist and the panel of consumers. Asking people to unveil their dialy shopping habits to the extent requested in this study is a delicate matter. Personal integrity is often directly connected to our personal economic situation, and therefore many people may be reluctant to participating in studies of this kind. Even if they volunteer to participate, being reassured at first that their integrity will be respected, events that radically change their personal financial situation – in one way or the other – may cause them to change their minds about participating. Loss of one participant not only deprives the study of future observations based on that individual, but it also makes it impossible to use the contributions from that individual up to her withdrawal.

Conclusion

Uncertainty forces economic agents to create "fix-points" in the future to avoid contingencies. A very important question for economists is what role these fix-points actually play in daily economic activity; to improve knowledge about this role we need to add to our already existing stock of empirical knowledge of sticky prices. But studies to obtain this knowledge have to be designed with regard to the particular properties of the object in focus: in our case this means the setting up of a two-panel data study to match the store-level development of product prices with the consumption decisions made by individual consumers. A study of this kind is resource demanding, in particular in terms of the researcher's time, but in the long term such studies enhance our knowledge of how the economic system actually works in a way that should merit allocation of appropriate resources.

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