

Cabral, Luís; Fishman, Arthur

Working Paper

Business as usual: A consumer search theory of sticky prices and asymmetric price adjustment

Working Paper, No. 2011-01

Provided in Cooperation with:

Department of Economics, Bar-Ilan University

Suggested Citation: Cabral, Luís; Fishman, Arthur (2010) : Business as usual: A consumer search theory of sticky prices and asymmetric price adjustment, Working Paper, No. 2011-01, Bar-Ilan University, Department of Economics, Ramat-Gan

This Version is available at:

<https://hdl.handle.net/10419/96067>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Business as Usual: A Consumer Search Theory of Sticky Prices and Asymmetric Price Adjustment

Luís Cabral*

IESE Business School and NYU

Arthur Fishman*

Bar Ilan University

This draft: September 2010

Abstract

Empirical evidence suggests that prices are sticky with respect to cost changes. Moreover, prices respond more rapidly to cost increases than to cost decreases. We develop a search theoretic model which is consistent with this evidence and allows for additional testable predictions. Our results are based on the assumption that buyers do not observe the sellers' costs, but know that cost changes are positively correlated across sellers. In equilibrium, a change in price is likely to induce consumer search, which explains sticky prices. Moreover, the signal conveyed by a price decrease is different from the signal conveyed by a price increase, which explains asymmetry in price adjustment.

*Cabral: Professor of Economics, Academic Director (New York Center), and SP-SP Research Fellow, all at IESE Business School; Professor of Economics, Stern School of Business, New York University (on leave); and Research Fellow, CEPR (London); lcabral@iese.edu. Fishman: Department of Economics, Bar Ilan University, Ramat Gan, Israel; afishman@biu.ac.il. A previous, preliminary version of this paper was circulated under the title "A Theory of Asymmetric Price Adjustment." We are grateful to Huseyin Yildirim and seminar participants at CORE, Duke, NYU, Yale and the Kansas City Fed for useful comments and suggestions.

1 Introduction

Empirical evidence suggests that prices are sticky: firms do not immediately adjust to changes in costs. For example, in a survey of 200 firms, Blinder et al. (1998) found that the median firm adjusts prices about once a year. Hall, Walsh, and Yates (2000) obtained similar results in a survey of 654 British companies. In a study of newsstand prices of 38 American magazines over 1953–79, Cecchetti (1986) determined that the number of years since the last price change ranged from 1.8 to 14 years. Kashyap (1995), in a study of the monthly prices of mail-order catalog goods, found an average of 14.7 months between price changes. MacDonald and Aaronson (2001) determined that restaurant prices display a median duration of about 10 months. In a broad sample of consumer goods, Klenow and Kryvtsov (2008) found that the median consumer good changes prices every 4.3 months.

The purpose of this paper is to develop a search theoretic model of sticky consumer prices. We consider an industry where input costs are sticky and show that consumer search costs lead to output prices that are stickier than input costs. To understand the mechanism for this “increasing stickiness” pattern, suppose that consumer prices are currently in equilibrium (specifically, in a Diamond-type equilibrium). The idea is that, if firm i ’s cost changes by a small amount, then firm i is better off by not changing its price. In fact, if price remains constant then consumers rationally believe there have been no cost shocks, and consequently refrain from searching: it’s business as usual. By contrast, changing price “rocks the boat,” that is, leads consumers to search; and the potential loss from consumers searching rivals’ prices outweighs the potential gain from adjusting price to its new optimal level.

While our analysis is motivated by evidence of price stickiness, we are also interested in the stylized fact that prices adjust (upward) more quickly to cost increases than (downward) to cost decreases (see Peltzman, 2000, and references therein). Our model accounts for such asymmetric behavior in a natural way. The idea is that a small price increase (decrease) signals a positive (negative) cost shock. As a result, the potential gains from search are greater following a small price decrease than a small price increase. This implies that the above effect (“business as usual” beats “rocking the boat”)

is especially relevant following a small cost decrease.

■ **Related literature.** A common explanation for price stickiness is that there is a fixed physical cost that firms must pay whenever they change a price — a menu cost (e.g, Sheshinski and Weiss, 1977, Levy, Bergen, Dutta, and Venable, 1997)). This approach is often criticized on the grounds that for most products it is hard to identify significant fixed physical costs of changing prices. Several other papers develop models in which consumer frictions lead to incomplete price adjustment. Stiglitz (1987) shows that a model with convex search costs can be consistent with real and nominal rigidities. Klemperer (1995), Kleshchelski and Vincent (2007) and Menzio (2006) show that rigidities may arise if it is costly for consumers to switch sellers. Nakamura and Steinsson (2005) show that prices might not fully adjust to cost increases when consumers form habits in individual goods which lock them in with specific sellers. Rotemberg (2005) develops a model in which firms may fail to increase prices in order not to antagonize customers, a hypothesis which is supported empirically by Anderson and Simester (2010). Mankiw and Reis (2002) and Reis (2006) develop models in which it is costly for firms to absorb, process and interpret information about costs and consequently only adjust prices at certain dates. Lewis (2005), Tappata (2009) and Yang and Ye (2008) develop search theoretic models to explain asymmetric price adjustment. Most closely related to our model are Benabou and Gertner (1993) and Fishman (1995), who use a similar framework to analyze equilibrium pricing when firms costs are determined as the product of a common inflationary factor and a privately observed idiosyncratic shock.

Although our paper share various features with the above literature, we make a distinctive contribution: we show that search costs imply a magnification in the degree of price stickiness, that is, equilibrium output prices are stickier than input prices.

The paper is structured as follows. In Section 2, we lay down the basic model structure. In Section 3, we present our main result regarding sticky prices. Section 4 considers an extension of the model which leads to a pattern of asymmetric adjustment of prices to costs. We conclude with Section 5.

2 Model

We consider a model with a continuum of firms (of mass two) and a continuum of consumers (of mass two as well). The firms are divided into two groups of equal size, A and B . Firm costs are identical within each group. For simplicity, we will refer to two firms, A and B , although there is a mass one of each type of firm.

Time is infinite and discrete: $t = 1, 2, \dots$. In each period, each consumer is randomly assigned to a firm, leaving each firm with an assigned consumer. Each firm sets its price p and each consumer demands a quantity $q(p) = a - p$ from the seller with the lowest price observed by that consumer. Specifically, while a consumer is assigned to a given firm, he has the option to search for another firm's price by paying a cost $s > 0$.

We have in mind a product which is consumed repeatedly and for which the quantity demanded is sensitive to price. Examples include cable, cell phone, and restaurant services, when the buyer is the final consumer;¹ and production inputs (such as flour), when the buyer is a firm (such as a bakery).

Let $\mu(p)$ be the consumer's surplus from buying at price p and $\pi(p; c)$ be a seller's profit given price p , constant unit cost c , and a mass one of consumers. Noting that $\pi(p; c)$ is concave, denote by $p^m(c)$ the unique monopoly price for a firm with cost c .

Seller i 's unit cost at time t , c_{it} , evolves according to a Markov process where the state is given by both sellers' costs. The Markov transition function is common knowledge, but not the cost levels. At each period t , firm i is informed about its own cost.

Consumers, by contrast, have limited information regarding firms. In each period, they observe the price set by the firm they are assigned to. Moreover, they observe the market's price distribution at periods $1, k + 1, 2k + 1$, and so on, where k is a positive integer. However, any changes in other firms'

1. The demand for cable and cell phone services is downward sloping to the extent that following a price increase consumers switch to a lower q tier or plan, respectively. The demand for restaurant meals is downward sloping to the extent that, as prices increase, consumers dine out less frequently or skip desert, wine, more expensive dishes, etc.

The model could also accommodate the case of unit demand by introducing heterogeneous consumers with different reservation prices. This would lead to a more complicated model.

prices (or in the price distribution) which occur between periods $n k + 1$ and $(n + 1) k$ are not observed.

Similarly, Firm A (B) observes the cost of Firm B (A) at periods $1, k + 1, 2 k + 1, \dots$ but does not observe any changes in the other firms' cost which occur between periods $n k + 1$ and $(n + 1) k$.

The idea of the above model assumption is that it is too costly for agents to continually update and interpret information about the economy, so agents are “inattentive” to new information most of the time and only update information at pre-specified intervals. The assumption that this updating is coordinated between consumers is clearly artificial and is made for tractability — in a richer model k would be endogenously derived from model parameters and the dates at which information is updated might be distributed across individuals.

The probability of a change in the state from one period to the next is given by γ ; that is, with probability $1 - \gamma$ both sellers' costs are the same as in the previous period. Moreover, if there is a cost change, we assume the new value of c_{it} is uniformly distributed in $[c_L, c_H]$. By an appropriate change in units — and with no loss in generality — we normalize $c_L = 0$ and $c_H = 1$.

Each period consumers are randomly assigned to a different seller, a mass one to each seller. This assumption simplifies the analysis by ensuring that it is optimal for sellers and buyers to maximize *current* profit and consumer surplus, respectively. In particular, since a firm's customers only observe its current price, it implies that a firm's strategy and the beliefs of its customers at $t = 2$ does not depend on its price at $t = 1$. Once consumers are assigned to sellers, the latter simultaneously set prices. Each seller's price is initially observed only by the consumers attached to it. Consumers then decide whether to observe the other seller's price, at a cost s .

Throughout the paper, we consider the case when $k = 2$, though many of our qualitative points apply more generally. Finally, we will be looking at Bayesian Equilibria (BE) of the above game.

3 Sticky prices

Recall that we assume $k = 2$, so that consumers are informed about the state at even numbered periods but not at odd numbered periods. Consider first an odd numbered period, say period 1, and suppose firms costs are close to each other: $c_{i1} \approx c_{j1}$. We will assume that the value of γ is small. (Below we make this statement more precise and also deal with the case when firms' costs are far apart.) For the purpose of deriving the equilibrium, it helps to think of the set of states when costs change as measure zero (thus, $\gamma = 0$). Note however that, by continuity, the results also hold for small γ . Moreover, at the end of the section we will show that, for specific values of s , the sticky-prices equilibrium developed below holds true for positive values of γ . Under the assumption that $\gamma = 0$ the result holds for any positive search cost s .

Let us first consider pricing in period $t = 1$. Since strategies and beliefs in $t = 2$ do not depend on $t = 1$ prices, the situation is analogous to the Diamond (1971) pricing game. In equilibrium, both firms set their monopoly price, which is given by $p^m(c) = (a + c)/2$. To see that this is indeed a Nash equilibrium, notice that, if both firms set the same price, then consumers have no incentive to search. Since consumers do not search, no firm has an incentive to set a different price. In fact, as Diamond (1971) has shown, this is the unique equilibrium.

Our main result concerns pricing at $t = 2$ (more generally, pricing at $1 < t \leq k$). We first note that a simple repetition of the pricing equilibrium in period 0 is not an equilibrium, in general. Specifically, suppose that firm A observes its cost changes by a small amount. Should it set a price equal to monopoly price as in the previous period? The answer is no. By changing its price, firm A signals to consumers that its cost has changed. Conditionally on firm A 's cost having changed, firm B 's cost has also changed (with probability one); in fact, it is uniformly distributed between 0 and 1. This implies that there are significant gains from consumer search. This implies in turn that there is a good chance firm A will lose its customers. By contrast, sticking to a constant price — not “rocking the boat” — assures firm A that there won't be any search. In fact, since the probability of a cost change is small, consumers rightly believe that, conditional on a sticky price, the likelihood of a cost change is very small, and thus the gains from search are lower than

the search cost. Our main result makes this statement more precise.

Proposition 1 *The following constitutes a Bayesian Equilibrium. The sellers' pricing policy is as follows:*

$$p_{i2} = \begin{cases} p^m(c_{i2}) & \text{if } c_{i2} \leq c' \\ p^m(c') & \text{if } c' < c_{i2} \leq c'' \\ p_{i1} & \text{if } c_{i2} > c'' \end{cases}$$

The buyers strategy is as follows:

If $p = p_{i1}$ or $p \leq p^m(c')$, then do not search.

Otherwise, search.

Proof of Proposition 1: We now show that the above strategies are indeed a Bayesian equilibrium. We begin by showing that the buyers' strategy is optimal and their beliefs consistent. If the buyer observes a price $p_{i2} = p_{i1}$, then with probability 1 costs have not changed; and, given the sellers' strategy, the rival firm's price has not changed. This implies that the gains from search are zero. Suppose now that the buyer observes $p \neq p_{i1}$. This implies that costs have changed. In particular, the rival firm's cost is uniformly distributed in $[0, 1]$. For a small value of p (specifically, for $p < p^m(c')$), expected surplus in case the buyer searches for the lowest price is given by

$$\int_0^c \mu(p^m(x)) dx + (1 - c) \mu(p^m(c)).$$

where c is the cost level such that $p = p^m(c)$. In words, if seller j 's cost is $x < c$, then the buyer receives surplus $\mu(p^m(x))$. If, on the other hand, $x > c$, then the buyer sticks with seller i 's $p^m(c)$ and earns a surplus $\mu(p^m(c))$.

Since $q(p) = a - p$, we have

$$\begin{aligned} p^m(c) &= \frac{1}{2}(a + c) \\ \mu(p) &= \frac{1}{2}(a - p)^2. \end{aligned}$$

Substituting in the above expressions and simplifying, we get a *net* expected benefit from searching equal to

$$R(c) = c^2 \left(\frac{a}{8} - \frac{c}{12} \right).$$

The derivative of $R(c)$ with respect to c is given by $\frac{(a-c)c}{4}$, which is positive. Moreover, $R(0) = 0$. It follows that there exists a positive value of c , say c' , such that, given the above seller strategies, the net benefit from search is positive if and only if $p_{i2} > p^m(c')$ (and $p_{i2} \neq p_{i1}$). Specifically, c' is given by $R(c') = s$.

Consider now the seller's strategy. Notice that, along the equilibrium path, no search takes place. This implies that, in considering what price to set, each firm is only concerned about its customers' search behavior. In other words, at best a firm manages not to lose its customers; it will never attract its rival's customers. For $c < c'$, the seller's strategy is clearly optimal: consumers do not search even as the seller sets its monopoly price.

If $p^m(c') < p_{i2} < p_{i1}$, then consumers search. Given the rival seller's pricing strategy, the deviating seller keeps its buyers if and only if the rival's cost is greater than $c''(c_{i1})$, which happens with probability $1 - c''(c_{i1})$. Of all the price levels between $p^m(c')$ and p_{i1} , the deviating seller prefers $p^m(c)$: it maximizes profits given a set of buyers; and the set of buyers does not depend on price (within that interval). It follows that the deviation profit is given by

$$(1 - c''(c_{i1})) (a - p^m(c)) (p^m(c) - c).$$

Since the profit function is quasi-concave, the best alternative price levels are $p^m(c')$ and p_{i1} . The seller prefers $p = p^m(c')$ if and only if

$$(a - p^m(c')) (p^m(c') - c) > (a - p_{i1}) (p_{i1} - c).$$

In the linear case we are considering, it can be shown that

$$(a - p^M(c')) (p^M(c') - c) - (a - p_{i1}) (p_{i1} - c) = \frac{1}{2} (c_{i1} - c') \left(\frac{c_{i1} + c'}{2} - c \right).$$

Let

$$c''(c_{i1}) \equiv \frac{c_{i1} + c'}{2}$$

Clearly, the above difference is positive if and only if $c < c''(c_{i1})$. It follows that the seller's best alternative to $p^m(c)$ is $p^m(c')$ if $c < c''(c_{i1})$ and p_{i1} otherwise. The no-deviation constraint is most binding precisely when $c = c''(c_{i1})$, in which case it becomes

$$(1 - c''(c_{i1})) (a - p^m(c''(c_{i1}))) (p^m(c''(c_{i1})) - c''(c_{i1})) \leq (a - p_{i1})(p_{i1} - c).$$

It can be shown that, if $c_{i1} < 1 < a$ (as we assume), then this conditions holds.

To conclude the analysis of the seller's strategy, notice that pricing above p_{i1} is clearly a dominated strategy as the seller would lose all of its customers. (Notice that the maximum value of cost is lower than p_{i1} , so the seller can always make a positive profit.) ■

Figure 1 provides a graphical representation of the equilibrium strategies. Notice that, if costs do not change, then prices do not change either. Moreover, there is a wide range of values of c_{i2} (specifically, $c_{i2} \in [c'', 1]$) such that prices remain unchanged even though costs change. In this sense, equilibrium pricing *magnifies* the stickiness of input costs: in period 1 (and more generally, in a period $t \leq k$), prices remain constant with greater probability than costs remain constant.

The assumption that $k = 2$ implies that consumers learn the firms' price distribution in period $t = 2 + 1 = 3$. This will lead firms to adjust prices to a new Diamond-type equilibrium. In other words, even if costs do not change from $t = 2$ to $t = 3$, prices will change (assuming costs, but not prices, changed in $t = 2$). In this sense, the pattern implied by the equilibrium above is one of delayed impact of cost changes on prices. Moreover, for higher values of k , we could have several small cost changes in periods $2, 3, \dots, k$, none of which would be reflected in a price change. In this sense, the above results imply that output prices change with lower frequency than input prices.

To summarize, the implication of the above equilibrium strategies is a pattern of price stickiness whereby (a) prices vary less frequently than costs, and (b) prices respond slowly to cost changes.

The intuition for this pattern is that a price change signals to consumers that costs have changed; and when costs change the expected gains from search are greater. Not wishing to induce search, firms stick to their previous

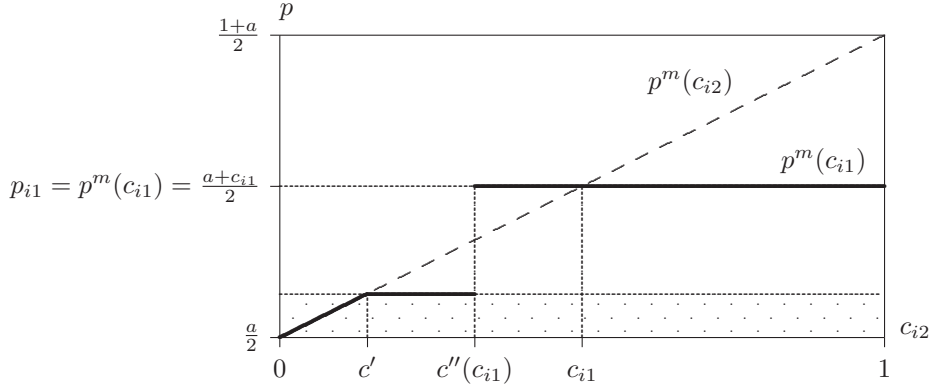


Figure 1: Equilibrium price as a function of cost.

price. For a given set of customers, a different price would lead to higher profits, but factoring in the expected losses from lost customers a price change becomes suboptimal. Formally, we show that the gains from adjusting price to a small cost change are of second order (by the envelope theorem), whereas the expected loss due to consumer searching and switching is of first order.

■ **Uniqueness.** While we have shown that the above is a Bayesian Equilibrium (BE), we should also note that it is not the unique BE. To see this, consider the situation when firm i 's initial cost is ϵ higher than firm j 's, where ϵ is a small number. Suppose that, if costs do not change, then seller i increases price by ϵ^2 , whereas seller j keeps the same price as before. Otherwise, the equilibrium price strategy is as before.

This pricing strategy is consistent with a BE. Out-of-equilibrium beliefs are as before: any price $p_{i2} \neq p_{i1} + \epsilon^2$ and $p_{i2} > p^m(c')$ leads consumers to search. Suppose there is no cost change. If firm i sets any price other than $p_{i1} + \epsilon^2$, it will either make less money on a per consumer basis or lose all consumers.²

By the above token, we can construct a continuum of BE. Ultimately,

2. Equilibria of this type can also be found when initial costs are identical. For example, suppose equilibrium calls for both firms to decrease price by ϵ even if costs have not changed. If a firm does not change its price, then consumers will search, find a firm with a slightly lower price (a firm who followed equilibrium strategies) and switch. It follows that the designated strategy is indeed an equilibrium strategy.

the selection of the particular equilibrium we consider is a matter of common sense: if costs do not change, there is no reason why prices should change. However, we should reinforce the idea that, while we are making this equilibrium selection assumption, we are *not* getting price stickiness by assumption. In fact, the thrust of Proposition 1 is that equilibrium strategies *magnify* the degree of stickiness in costs.

■ **Large cost differences.** The above result assumes that, in period $t = 1$, firms' costs are sufficiently close that each firm's equilibrium price is its monopoly price. We now consider the case when they are not. Specifically, suppose that $c_{i1} > c_{j1}$. Then, as proved by Reinganum (1979), equilibrium prices (at $t = 1$) are given by $p_{j1} = p^m(c_{j1})$ and $p_{i1} = \min\{\hat{p}_{i1}, p^m(c_{i1})\}$, where \hat{p} is (implicitly) defined by $\mu(p^m(c_{j1})) - \mu(\hat{p}_{i1}) = s$. Thus, if $c_{i1} - c_{j1}$ is sufficiently large, then $p_{i1} < p^m(c_{i1})$.

Now consider what happens at $t = 2$. Suppose first that there is no cost change. Then neither firm i nor firm j have an incentive to change their price (for the same reasons as before). This is clear for firm j , who is pricing at monopoly level. It is also true for firm i because any price change would lead consumers to search, which in turn would lead firm i to lose all of its customers (unless it prices below firm j , in which case it keeps the same number of customers but makes less profit per customer).

Consider now the case when there is a small cost change. If firm j 's cost decreases by a small amount or increases by any amount, then, by the same argument as in Proposition 1, firm j is better off by keeping its price fixed. In fact, adjusting price to its new optimal level would lead to a second-order increase in profit per customer. However, conditionally on costs having changed, there is a positive probability that the rival's cost decreases by a large amount; and since a price change leads to search, there is a positive probability that firm j is left with no consumers.

Consider now firm i 's case. Suppose its cost changes by a small amount. Now it's no longer the case that keeping price fixed is necessarily optimal, because firm i 's gain from adjusting price might be of first-order magnitude. Therefore, it is conceivable that for some parameter values firm i is better off by adjusting its price in the direction of the monopoly price level.

■ **Upper limit on γ .** In the analysis of the consumer strategy, we have assumed that γ is very small, that is, consumers assume that most likely costs have not changed — so that, observing no change in price, they assume that costs have not changed. Although we assumed that $\gamma = 0$, all we need is that $\gamma < \gamma'$. In the Appendix, we explicitly determine the upper bound γ' . For example, if $a = 2$, $s = 1/200$ and $c_{i1} = c_{j1} = \frac{1}{2}$, then we get $\gamma < \gamma' \approx .133$. If $s = 1/100$, then $\gamma < \gamma' \approx .266$; if $s = 1/20$, then $\gamma < \gamma' \approx .979$. So, while our general result assumes that γ is small, the above example suggests that we don't need γ to be particularly close to zero.

4 Asymmetric price adjustment

Several studies (Peltzman, 2000, and references therein) indicate that prices decrease more slowly when costs go down than they increase when costs go up. In this section we show that our model can accommodate this pattern in a natural way. Until now we assumed that, conditional on a cost change, firm i 's cost is independent of firm j 's. One would expect some positive correlation between firm costs when they change. We now consider a revised version of our model where costs are correlated.

As before, costs change with a (small) probability γ . We now assume that, if costs change, then either both costs increase or both costs decrease. Specifically, costs are independently and uniformly distributed in $[0, c_{i1}]$ (if costs decrease) or $[c_{i1}, 1]$ (if costs increase). For simplicity, we also assume that $c_{i1} = c_{j1}$.

The derivation of a BE is similar to Section 3. The crucial difference is that firms increase prices when their cost increases. The reason is that a price increase by firm i signals a cost increase by firm i . And, to the extent that costs are correlated, it also signals an increase in firm j 's price. It follows that consumers may prefer not to search despite a cost increase, provided it's small enough.

Proposition 2 *The following constitutes a Bayesian Equilibrium. The sell-*

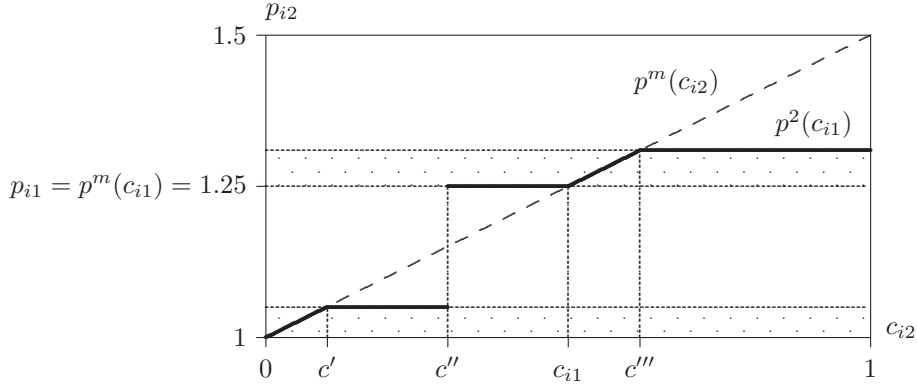


Figure 2: Equilibrium price as a function of cost in numerical example. Costs are uniformly distributed; demand is linear: $q = 2 - p$; initial cost is $c_{i1} = .5$ for both firms. The equilibrium cost thresholds are given by $c' = .102$, $c'' = .301$, $c''' = .619$.

ers' pricing policy is as follows:

$$p_{i2} = \begin{cases} p^m(c_{i2}) & \text{if } c_{i2} \leq c' \\ p^m(c') & \text{if } c' < c_{i2} \leq c''(c_{i1}) \\ p_{i1} & \text{if } c''(c_{i1}) < c_{i2} \leq c_{i1} \\ p^m(c_{i2}) & \text{if } c_{i1} < c_{i2} \leq c''' \\ p^m(c''') & \text{if } c_{i2} > c''' \end{cases}$$

The buyers' strategy is as follows:

$$\begin{aligned} \text{if } p_{i2} &\leq p^m(c') && \text{then do not search} \\ \text{if } p^m(c') &< p_{i2} < p_{i1} && \text{then search} \\ \text{if } p_{i1} &\leq p_{i2} \leq p^m(c''') && \text{then do not search} \\ \text{if } p_{i2} &> p^m(c''') && \text{then search} \end{aligned}$$

These equilibrium strategies are illustrated in Figure 2. Similarly to Section 3, they imply a pattern of price stickiness whereby (a) prices vary less frequently than costs, and (b) prices respond slowly to cost changes. Moreover, we now notice a clear asymmetry in the way prices respond to small

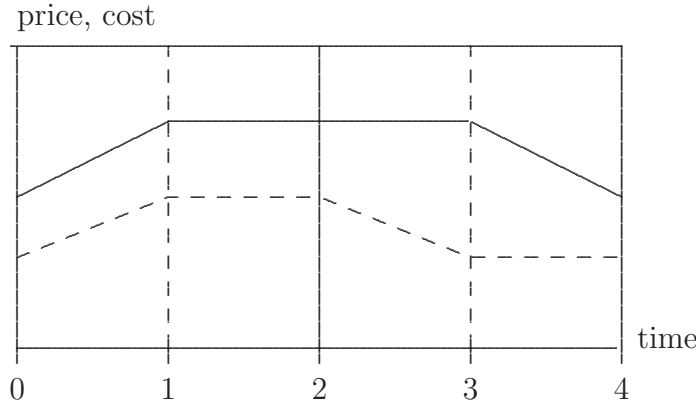


Figure 3: Cost changes and price changes.

cost changes: prices remain unchanged following small cost decreases but increase following small cost increases. Finally, we never observe large price increases, whereas we do observe large price decreases.

■ **Empirical implications.** Proposition 2 shows that when the *direction* of cost change is sufficiently correlated across firms, then, for small cost changes, prices respond more rapidly to cost increases than to cost decreases. We now derive a series of empirical implications of this theoretical result.

□ **Speed of price response to cost changes.** As Figure 3 illustrates, our equilibrium seems consistent with the idea that, for small cost changes, prices respond more rapidly to cost increases than to cost decreases. Specifically, the figure considers a situation where costs increase by a bit from $t = 1$ to $t = 2$ and then decrease by a bit from $t = 3$ to $t = 4$. As can be seen, a cost increase is immediately reflected in a price increase; whereas a cost decrease results in a price decrease with a lag. Peltzman (2000) presents evidence that is consistent with the pattern illustrated by Figure 3.

□ **Correlation between cost changes and price changes.** A related empirical implication is that there is a greater correlation between cost changes and price changes on the way up than on the way down. Buckle and Carlson (1998) survey New Zealand businesses and ask them in separate

questions whether prices were raised or lowered in a particular quarter; and whether costs increased or decreased. They find that price and cost increases paired more frequently in the same quarter than price and cost decreases.

□ **Frequency and size of price changes.** Our model also suggests that price decreases are less frequent than price increases; and that the absolute value of price increases is smaller than the absolute value of price decreases. The empirical evidence seems consistent with this prediction. See Klenow and Kryvstov (2008) for the U.S. and Dhyne et al (2004) for the Euro area.

□ **Asymmetry in the small.** In our revised model, the asymmetry in frequency of price changes results from the fact that small cost decreases lead to no change in price. More generally, we expect that the asymmetry in rates of price adjustment is particularly high for small cost changes. Levy et al (2005) present evidence that seems consistent with this prediction. Analyzing scanner data that cover 29 product categories over a eight-year period from a large Mid-western supermarket chain, they show that small price increases occur more frequently than small price decreases; no such asymmetry is found for larger price changes.

5 Conclusion

Much of the current literature on price rigidity is based on the idea of menu costs. However, in order to fit the stylized facts on price rigidity the required size of menu costs is rather high. In this paper, we present a consumer search theory of price rigidity that does not require menu costs. To some extent, one may reinterpret the idea of menu costs to include a decrease in seller profit resulting from price change. In this broad sense, our model does feature menu costs. However, such loose interpretation of menu costs is of little help: the size of such menu cost is not fixed as in the traditional physical menu cost case; in particular, it will be different depending on whether price increases or decreases.

Appendix

■ **Derivation of upper bound on γ .** Conditional on observing no price change, the posterior that there has been a cost shock is given by

$$\frac{(1 - c''(c_{i1})) \gamma}{(1 - c''(c_{i1})) \gamma + 1 - \gamma}$$

Conditional on a cost shock, the expected extra surplus in case of search is given by

$$\begin{aligned} & \left(\int_0^{c'} \mu(p^m(x)) dx + (c''(c_{i1}) - c') \mu(p^m(c')) + (1 - c''(c_{i1})) \mu(p_1) \right) - \mu(p_1) = \\ & = \int_0^{c'} \mu(p^m(x)) dx + (c''(c_{i1}) - c') \mu(p^m(c')) - c''(c_{i1}) \mu(p_1) \end{aligned}$$

The no-search condition thus becomes

$$\begin{aligned} & \frac{(1 - c''(c_{i1})) \gamma}{(1 - c''(c_{i1})) \gamma + 1 - \gamma} \\ & \left(\int_0^{c'} \mu(p^m(x)) dx + (c''(c_{i1}) - c') \mu(p^m(c')) - c''(c_{i1}) \mu(p_1) \right) \leq s \end{aligned}$$

Assuming $a = 2$, $s = 1/200$ and $c_{i1} = c_{j1} = \frac{1}{2}$, we get $\gamma < \gamma' \approx .133$. If $s = 1/100$, then $\gamma < \gamma' \approx .266$; if $s = 1/20$, then $\gamma < \gamma' \approx .979$. ■

Proof of Proposition 2: We now show that the above strategies constitute a Bayesian equilibrium. For low values of c , the seller's strategy is similar to Section 3. As before, we have threshold levels c' and c'' . One difference is that, by observing a price lower than p_{i1} , consumers believe costs to be distributed in $[0, c_{i1}]$. This implies greater expected benefits from searching. As a result, we obtain lower values of c' , c'' than in Section 3.

Now suppose that p_{i2} is greater than, but close to, p_{i1} . Given the sellers' pricing strategy, buyers infer that costs are uniformly distributed in $[c_{i1}, 1]$.

By searching, a buyer receives an expected surplus

$$\frac{1}{(1 - c_{i1})} \left(\int_{c_{i1}}^c \mu(p^m(x)) dx + (1 - c_{i1}) \mu(p^m(c)) \right).$$

where c is the cost level such that $p = p^m(c)$. In words, if seller j 's cost is $x < c$, then the buyer receives surplus $\mu(p^m(x))$. If, on the other hand, $x > c$, then the buyer sticks with firm i 's $p^m(c)$.

By not searching, the buyer receives a surplus $\mu(p^m(c))$. Given our assumption of linear demand, we get a *net* expected benefit from searching equal to

$$R(c) = \frac{(a - c_{i1})^3 - (a - c)^3}{24 c_{i1}} + \frac{(a - c)^2 (c_{i1} - c)}{8 (1 - c_{i1})}.$$

The derivative of this expression with respect to c is given by $\frac{(a-c)(c-c_{i1})}{4(1-c_{i1})}$, which is positive. Moreover, $R(c_{i1}) = 0$. It follows that there exists a value of c greater than c_{i1} such that the net benefit from search is equal to the search cost. Let c''' be such value, that is, $R(c''') = s$. It follows that, for $p_{i1} < p_{i2} \leq p^m(c''')$, consumers are better off by not searching.

By the same token, if $p_{i2} > p^m(c''')$, then consumers prefer to search. The fact $p_{i2} > p_{i1}$ signals that costs are uniformly distributed in $[c_{i1}, 1]$, as in the previous case; and since $R(c) > s$, it pays to search.

This concludes the proof that the buyers' strategy is a best response to the seller's strategy; and that the buyers' beliefs are consistent with the sellers' strategy. Regarding the seller's strategy, the argument is essentially identical to Section 3. ■

References

- ANDERSON, ERIC, AND DUNCAN SIMESTER (2008), “Price Stickiness and Customer Antagonism,” *Quarterly Journal of Economics* **125**, 729–776.
- BENABOU, ROLAND, AND ROBERT GERTNER (1993), “Search with Learning from Prices: Does Increased Inflationary Uncertainty Lead to Higher Markups?,” *Review of Economic Studies* **60**, 69–94.
- BLINDER, ALAN S., ELIE R. D. CANETTI, DAVID E. LEBOW, AND JEREMY B. RUDD (1998), *Asking about Prices: A New Approach to Understanding Price Stickiness*, New York: Sage Foundation.
- BUCKLE, ROBERT A, AND JOHN A CARLSON (1998), “Inflation and Asymmetric Output Adjustment by Firms,” *Economic Inquiry* **36**, 215–228.
- CECCHETTI, STEPHEN G. (1986), “The Frequency of Price Adjustment: A Study of the Newsstand Prices of Magazines,” *Journal of Econometrics* **31**, 255–274.
- DIAMOND, PETER (1971), “A Model of Price Adjustment,” *Journal of Economic Theory* **3**, 156–168.
- DHYNE, EMMANUEL, LUIS J ÁLVAREZ, HERVÉ LE BIHAN, GIOVANNI VERONESE, DANIEL DIAS, JOHANNES HOFFMAN, NICOLE JONKER, PATRICK LÜNNEMANN, FAVIO RUMLER, JOUKO VILMUNEN (2004), “Price Setting in the Euro Area: Some Stylized Facts From Individual Consumer Price Data,” European Central Bank, November.
- FISHMAN, ARTHUR (1996), “Search With Learning and Price Adjustment Dynamics,” *Quarterly Journal of Economics* **111**, 253–268.
- HALL, SIMON, MARK WALSH, AND ANTHONY YATES (2000), “Are UK Companies Prices Sticky?,” *Oxford Economics Papers* **52**, 425–46.
- KASHYAP, ANIL K. (1995), “Sticky Prices: New Evidence from Retail Catalogs,” *Quarterly Journal of Economics* **110**, 245–274.
- KLEMPERER, PAUL (1995), “Competition when Consumers have Switching Costs: An Overview with Applications to Industrial Organization, Macroeconomics, and International Trade,” *Review of Economic Studies* **62**, 515–539.

- KLENOW, PETER, AND OLEKSIY KRYVTSOV (2008), “State-Dependent or Time-Dependent Pricing: Does it Matter for Recent U.S. Inflation?,” *Quarterly Journal of Economics* **123**, 863–904.
- KLESCHCHELSKIY, ISAAC, AND NICOLAS VINCENT (2007), “Market Share and Price Rigidity,” mimeo.
- LEVY, DANIEL, HAIPENG (ALLAN) CHEN, ROURAV RAY (2008), “Asymmetric Price Adjustment ‘in the Small:’ An Implication of Rational Inattention,” *Journal of Monetary Economics* **55**, 728–737.
- LEVY D., M. BERGEN, S. DUTTA, AND R. VENABLE (1997), “The Magnitude of Menu Costs: Direct Evidence from Large US Supermarket Chains,” *Quarterly Journal of Economics* **112**, 791–825.
- LEWIS, MATTHEW (2005), “Asymmetric Price Adjustment and Consumer Search: An Examination of the Retail Gasoline Market,” October. forthcoming Journal of Economics Management and Strategy
- MACDONALD J. M., AARONSON D. (2006), “How Firms Construct Price Changes: Evidence from Restaurant Responses to Increased Minimum Wages,” *American Journal of Agricultural Economics* **88**, 292–307.
- MANKIW N. GREGORY, AND RICARDO REIS (2002), “Sticky Information Sticky Prices: A Proposal to Replace the New Keynesian Phillips Curve,” *Quarterly Journal of Economics* **117**, 1295–1328.
- MENZIO, G. (2007), “A Search Theory of Rigid Prices,” working paper.
- NAKAMURA, EMI, AND JON STEINSSON (2005), “Price Setting in Forward-Looking Customer Markets,” Harvard University.
- PELTZMAN, SAM (2000), “Prices Rise Faster Than They Fall,” *Journal of Political Economy* **108**, 466–502.
- REINGANUM, JENNIFER F (1979), “A Simple Model of Equilibrium Price Dispersion,” *Journal of Political Economy* **88**, 851–858.
- REIS, RICARDO (2006), “Inattentive Producers,” *Review of Economic Studies* **73**, 793–821.
- ROTEMBERG J. J. (2005), “Customer Anger at Price Increases, Changes in the Frequency of Price Adjustment and Monetary Policy,” *Journal of Monetary Economics* **52**, 829–852.

- SHESHINSKI, EYTAN, AND YORAM WEISS (1977), “Inflation and Costs of Price Adjustment,” *Review of Economic Studies* **44**, 287–304.
- STIGLITZ, JOSEPH E. (1987), “Competition and the Number of Firms in a Market: Are Duopolies More Competitive than Atomistic Markets?,” *Journal of Political Economy* **95**, 1041–1061.
- TAPPATA, MARIANO (2009), “Rockets and Feathers. Understanding Asymmetric Pricing,” *Rand Journal of Economics* **40**, 673–687.
- YANG, HUANXING, AND LIXIN YE (2008), “Search with Learning: Understanding Asymmetric Price Adjustments,” *Rand Journal of Economics* **39**, 547–564.

Bar-Ilan University
Department of Economics
WORKING PAPERS

- 1-01 **The Optimal Size for a Minority**
Hillel Rapoport and Avi Weiss, January 2001.
- 2-01 **An Application of a Switching Regimes Regression to the Study of Urban Structure**
Gershon Alperovich and Joseph Deutsch, January 2001.
- 3-01 **The Kuznets Curve and the Impact of Various Income Sources on the Link Between Inequality and Development**
Joseph Deutsch and Jacques Silber, February 2001.
- 4-01 **International Asset Allocation: A New Perspective**
Abraham Lioui and Patrice Poncet, February 2001.
- 5-01 **מודל המועדון והקהילה החרדית**
יעקב רוזנברג, פברואר 2001.
- 6-01 **Multi-Generation Model of Immigrant Earnings: Theory and Application**
Gil S. Epstein and Tikva Lecker, February 2001.
- 7-01 **Shattered Rails, Ruined Credit: Financial Fragility and Railroad Operations in the Great Depression**
Daniel A. Schiffman, February 2001.
- 8-01 **Cooperation and Competition in a Duopoly R&D Market**
Damiano Bruno Silipo and Avi Weiss, March 2001.
- 9-01 **A Theory of Immigration Amnesties**
Gil S. Epstein and Avi Weiss, April 2001.
- 10-01 **Dynamic Asset Pricing With Non-Redundant Forwards**
Abraham Lioui and Patrice Poncet, May 2001.
- 11-01 **Macroeconomic and Labor Market Impact of Russian Immigration in Israel**
Sarit Cohen and Chang-Tai Hsieh, May 2001.

Electronic versions of the papers are available at
http://www.biu.ac.il/soc/ec/wp/working_papers.html

- 12-01 **Network Topology and the Efficiency of Equilibrium**
Igal Milchtaich, June 2001.
- 13-01 **General Equilibrium Pricing of Trading Strategy Risk**
Abraham Lioui and Patrice Poncet, July 2001.
- 14-01 **Social Conformity and Child Labor**
Shirit Katav-Herz, July 2001.
- 15-01 **Determinants of Railroad Capital Structure, 1830–1885**
Daniel A. Schiffman, July 2001.
- 16-01 **Political-Legal Institutions and the Railroad Financing Mix, 1885–1929**
Daniel A. Schiffman, September 2001.
- 17-01 **Macroeconomic Instability, Migration, and the Option Value of Education**
Eliakim Katz and Hillel Rapoport, October 2001.
- 18-01 **Property Rights, Theft, and Efficiency: The Biblical Waiver of Fines in the Case of Confessed Theft**
Eliakim Katz and Jacob Rosenberg, November 2001.
- 19-01 **Ethnic Discrimination and the Migration of Skilled Labor**
Frédéric Docquier and Hillel Rapoport, December 2001.
- 1-02 **Can Vocational Education Improve the Wages of Minorities and Disadvantaged Groups? The Case of Israel**
Shoshana Neuman and Adrian Ziderman, February 2002.
- 2-02 **What Can the Price Gap between Branded and Private Label Products Tell Us about Markups?**
Robert Barsky, Mark Bergen, Shantanu Dutta, and Daniel Levy, March 2002.
- 3-02 **Holiday Price Rigidity and Cost of Price Adjustment**
Daniel Levy, Georg Müller, Shantanu Dutta, and Mark Bergen, March 2002.
- 4-02 **Computation of Completely Mixed Equilibrium Payoffs**
Igal Milchtaich, March 2002.
- 5-02 **Coordination and Critical Mass in a Network Market – An Experimental Evaluation**
Amir Etziony and Avi Weiss, March 2002.

- 6-02 **Inviting Competition to Achieve Critical Mass**
Amir Etziony and Avi Weiss, April 2002.
- 7-02 **Credibility, Pre-Production and Inviting Competition in a Network Market**
Amir Etziony and Avi Weiss, April 2002.
- 8-02 **Brain Drain and LDCs' Growth: Winners and Losers**
Michel Beine, Frédéric Docquier, and Hillel Rapoport, April 2002.
- 9-02 **Heterogeneity in Price Rigidity: Evidence from a Case Study Using Micro-Level Data**
Daniel Levy, Shantanu Dutta, and Mark Bergen, April 2002.
- 10-02 **Price Flexibility in Channels of Distribution: Evidence from Scanner Data**
Shantanu Dutta, Mark Bergen, and Daniel Levy, April 2002.
- 11-02 **Acquired Cooperation in Finite-Horizon Dynamic Games**
Igal Milchtaich and Avi Weiss, April 2002.
- 12-02 **Cointegration in Frequency Domain**
Daniel Levy, May 2002.
- 13-02 **Which Voting Rules Elicit Informative Voting?**
Ruth Ben-Yashar and Igal Milchtaich, May 2002.
- 14-02 **Fertility, Non-Altruism and Economic Growth: Industrialization in the Nineteenth Century**
Elise S. Brezis, October 2002.
- 15-02 **Changes in the Recruitment and Education of the Power Elites in Twentieth Century Western Democracies**
Elise S. Brezis and François Crouzet, November 2002.
- 16-02 **On the Typical Spectral Shape of an Economic Variable**
Daniel Levy and Hashem Dezhbakhsh, December 2002.
- 17-02 **International Evidence on Output Fluctuation and Shock Persistence**
Daniel Levy and Hashem Dezhbakhsh, December 2002.
- 1-03 **Topological Conditions for Uniqueness of Equilibrium in Networks**
Igal Milchtaich, March 2003.
- 2-03 **Is the Feldstein-Horioka Puzzle Really a Puzzle?**
Daniel Levy, June 2003.

- 3-03 **Growth and Convergence across the US: Evidence from County-Level Data**
Matthew Higgins, Daniel Levy, and Andrew Young, June 2003.
- 4-03 **Economic Growth and Endogenous Intergenerational Altruism**
Hillel Rapoport and Jean-Pierre Vidal, June 2003.
- 5-03 **Remittances and Inequality: A Dynamic Migration Model**
Frédéric Docquier and Hillel Rapoport, June 2003.
- 6-03 **Sigma Convergence Versus Beta Convergence: Evidence from U.S. County-Level Data**
Andrew T. Young, Matthew J. Higgins, and Daniel Levy, September 2003.
- 7-03 **Managerial and Customer Costs of Price Adjustment: Direct Evidence from Industrial Markets**
Mark J. Zbaracki, Mark Ritson, Daniel Levy, Shantanu Dutta, and Mark Bergen, September 2003.
- 8-03 **First and Second Best Voting Rules in Committees**
Ruth Ben-Yashar and Igal Milchtaich, October 2003.
- 9-03 **Shattering the Myth of Costless Price Changes: Emerging Perspectives on Dynamic Pricing**
Mark Bergen, Shantanu Dutta, Daniel Levy, Mark Ritson, and Mark J. Zbaracki, November 2003.
- 1-04 **Heterogeneity in Convergence Rates and Income Determination across U.S. States: Evidence from County-Level Data**
Andrew T. Young, Matthew J. Higgins, and Daniel Levy, January 2004.
- 2-04 **"The Real Thing:" Nominal Price Rigidity of the Nickel Coke, 1886-1959**
Daniel Levy and Andrew T. Young, February 2004.
- 3-04 **Network Effects and the Dynamics of Migration and Inequality: Theory and Evidence from Mexico**
David McKenzie and Hillel Rapoport, March 2004.
- 4-04 **Migration Selectivity and the Evolution of Spatial Inequality**
Ravi Kanbur and Hillel Rapoport, March 2004.
- 5-04 **Many Types of Human Capital and Many Roles in U.S. Growth: Evidence from County-Level Educational Attainment Data**
Andrew T. Young, Daniel Levy and Matthew J. Higgins, March 2004.

- 6-04 **When Little Things Mean a Lot: On the Inefficiency of Item Pricing Laws**
Mark Bergen, Daniel Levy, Sourav Ray, Paul H. Rubin and Benjamin Zeligler,
May 2004.
- 7-04 **Comparative Statics of Altruism and Spite**
Igal Milchtaich, June 2004.
- 8-04 **Asymmetric Price Adjustment in the Small: An Implication of Rational Inattention**
Daniel Levy, Haipeng (Allan) Chen, Sourav Ray and Mark Bergen, July 2004.
- 1-05 **Private Label Price Rigidity during Holiday Periods**
Georg Müller, Mark Bergen, Shantanu Dutta and Daniel Levy, March 2005.
- 2-05 **Asymmetric Wholesale Pricing: Theory and Evidence**
Sourav Ray, Haipeng (Allan) Chen, Mark Bergen and Daniel Levy,
March 2005.
- 3-05 **Beyond the Cost of Price Adjustment: Investments in Pricing Capital**
Mark Zbaracki, Mark Bergen, Shantanu Dutta, Daniel Levy and Mark Ritson,
May 2005.
- 4-05 **Explicit Evidence on an Implicit Contract**
Andrew T. Young and Daniel Levy, June 2005.
- 5-05 **Popular Perceptions and Political Economy in the Contrived World of Harry Potter**
Avichai Snir and Daniel Levy, September 2005.
- 6-05 **Growth and Convergence across the US: Evidence from County-Level Data (revised version)**
Matthew J. Higgins, Daniel Levy, and Andrew T. Young , September 2005.
- 1-06 **Sigma Convergence Versus Beta Convergence: Evidence from U.S. County-Level Data (revised version)**
Andrew T. Young, Matthew J. Higgins, and Daniel Levy, June 2006.
- 2-06 **Price Rigidity and Flexibility: Recent Theoretical Developments**
Daniel Levy, September 2006.
- 3-06 **The Anatomy of a Price Cut: Discovering Organizational Sources of the Costs of Price Adjustment**
Mark J. Zbaracki, Mark Bergen, and Daniel Levy, September 2006.

- 4-06 **Holiday Non-Price Rigidity and Cost of Adjustment**
Georg Müller, Mark Bergen, Shantanu Dutta, and Daniel Levy.
September 2006.
- 2008-01 **Weighted Congestion Games With Separable Preferences**
Igal Milchtaich, October 2008.
- 2008-02 **Federal, State, and Local Governments: Evaluating their Separate Roles in US Growth**
Andrew T. Young, Daniel Levy, and Matthew J. Higgins, December 2008.
- 2008-03 **Political Profit and the Invention of Modern Currency**
Dror Goldberg, December 2008.
- 2008-04 **Static Stability in Games**
Igal Milchtaich, December 2008.
- 2008-05 **Comparative Statics of Altruism and Spite**
Igal Milchtaich, December 2008.
- 2008-06 **Abortion and Human Capital Accumulation: A Contribution to the Understanding of the Gender Gap in Education**
Leonid V. Azarnert, December 2008.
- 2008-07 **Involuntary Integration in Public Education, Fertility and Human Capital**
Leonid V. Azarnert, December 2008.
- 2009-01 **Inter-Ethnic Redistribution and Human Capital Investments**
Leonid V. Azarnert, January 2009.
- 2009-02 **Group Specific Public Goods, Orchestration of Interest Groups and Free Riding**
Gil S. Epstein and Yosef Mealem, January 2009.
- 2009-03 **Holiday Price Rigidity and Cost of Price Adjustment**
Daniel Levy, Haipeng Chen, Georg Müller, Shantanu Dutta, and Mark Bergen,
February 2009.
- 2009-04 **Legal Tender**
Dror Goldberg, April 2009.
- 2009-05 **The Tax-Foundation Theory of Fiat Money**
Dror Goldberg, April 2009.

- 2009-06 **The Inventions and Diffusion of Hyperinflatable Currency**
Dror Goldberg, April 2009.
- 2009-07 **The Rise and Fall of America's First Bank**
Dror Goldberg, April 2009.
- 2009-08 **Judicial Independence and the Validity of Controverted Elections**
Raphaël Franck, April 2009.
- 2009-09 **A General Index of Inherent Risk**
Adi Schnytzer and Sara Westreich, April 2009.
- 2009-10 **Measuring the Extent of Inside Trading in Horse Betting Markets**
Adi Schnytzer, Martien Lamers and Vasiliki Makropoulou, April 2009.
- 2009-11 **The Impact of Insider Trading on Forecasting in a Bookmakers' Horse Betting Market**
Adi Schnytzer, Martien Lamers and Vasiliki Makropoulou, April 2009.
- 2009-12 **Foreign Aid, Fertility and Population Growth: Evidence from Africa**
Leonid V. Azarnert, April 2009.
- 2009-13 **A Reevaluation of the Role of Family in Immigrants' Labor Market Activity: Evidence from a Comparison of Single and Married Immigrants**
Sarit Cohen-Goldner, Chemi Gotlibovski and Nava Kahana, May 2009.
- 2009-14 **The Efficient and Fair Approval of "Multiple-Cost-Single-Benefit" Projects Under Unilateral Information**
Nava Kahanaa, Yosef Mealem and Shmuel Nitzan, May 2009.
- 2009-15 **Après nous le Déluge: Fertility and the Intensity of Struggle against Immigration**
Leonid V. Azarnert, June 2009.
- 2009-16 **Is Specialization Desirable in Committee Decision Making?**
Ruth Ben-Yashar, Winston T.H. Koh and Shmuel Nitzan, June 2009.
- 2009-17 **Framing-Based Choice: A Model of Decision-Making Under Risk**
Kobi Kriesler and Shmuel Nitzan, June 2009.
- 2009-18 **Demystifying the 'Metric Approach to Social Compromise with the Unanimity Criterion'**
Shmuel Nitzan, June 2009.

- 2009-19 **On the Robustness of Brain Gain Estimates**
Michel Beine, Frédéric Docquier and Hillel Rapoport, July 2009.
- 2009-20 **Wage Mobility in Israel: The Effect of Sectoral Concentration**
Ana Rute Cardoso, Shoshana Neuman and Adrian Ziderman, July 2009.
- 2009-21 **Intermittent Employment: Work Histories of Israeli Men and Women, 1983–1995**
Shoshana Neuman and Adrian Ziderman, July 2009.
- 2009-22 **National Aggregates and Individual Disaffiliation: An International Study**
Pablo Brañas-Garza, Teresa García-Muñoz and Shoshana Neuman, July 2009.
- 2009-23 **The Big Carrot: High-Stakes Incentives Revisited**
Pablo Brañas-Garza, Teresa García-Muñoz and Shoshana Neuman, July 2009.
- 2009-24 **The Why, When and How of Immigration Amnesties**
Gil S. Epstein and Avi Weiss, September 2009.
- 2009-25 **Documenting the Brain Drain of «la Crème de la Crème»: Three Case-Studies on International Migration at the Upper Tail of the Education Distribution**
Frédéric Docquier and Hillel Rapoport, October 2009.
- 2009-26 **Remittances and the Brain Drain Revisited: The Microdata Show That More Educated Migrants Remit More**
Albert Bollard, David McKenzie, Melanie Morten and Hillel Rapoport, October 2009.
- 2009-27 **Implementability of Correlated and Communication Equilibrium Outcomes in Incomplete Information Games**
Igal Milchtaich, November 2009.
- 2010-01 **The Ultimatum Game and Expected Utility Maximization – In View of Attachment Theory**
Shaul Almakias and Avi Weiss, January 2010.
- 2010-02 **A Model of Fault Allocation in Contract Law – Moving From Dividing Liability to Dividing Costs**
Osnat Jacobi and Avi Weiss, January 2010.

- 2010-03 **Coordination and Critical Mass in a Network Market: An Experimental Investigation**
Bradley J. Ruffle, Avi Weiss and Amir Etziony, February 2010.
- 2010-04 **Immigration, fertility and human capital: A model of economic decline of the West**
Leonid V. Azarnert, April 2010.
- 2010-05 **Is Skilled Immigration Always Good for Growth in the Receiving Economy?**
Leonid V. Azarnert, April 2010.
- 2010-06 **The Effect of Limited Search Ability on the Quality of Competitive Rent-Seeking Clubs**
Shmuel Nitzan and Kobi Kriesler, April 2010.
- 2010-07 **Condorcet vs. Borda in Light of a Dual Majoritarian Approach**
Eyal Baharad and Shmuel Nitzan, April 2010.
- 2010-08 **Prize Sharing in Collective Contests**
Shmuel Nitzan and Kaoru Ueda, April 2010.
- 2010-09 **Network Topology and Equilibrium Existence in Weighted Network Congestion Games**
Igal Milchtaich, May 2010.
- 2010-10 **The Evolution of Secularization: Cultural Transmission, Religion and Fertility Theory, Simulations and Evidence**
Ronen Bar-El, Teresa García-Muñoz, Shoshana Neuman and Yossef Tobol, June 2010.
- 2010-11 **The Economics of Collective Brands**
Arthur Fishman, Israel Finkelstein, Avi Simhon and Nira Yacouel, July 2010.
- 2010-12 **Interactions Between Local and Migrant Workers at the Workplace**
Gil S. Epstein and Yosef Mealem, August 2010.
- 2010-13 **A Political Economy of the Immigrant Assimilation: Internal Dynamics**
Gil S. Epstein and Ira N. Gang, August 2010.
- 2010-14 **Attitudes to Risk and Roulette**
Adi Schnytzer and Sara Westreich, August 2010.

- 2010-15 **Life Satisfaction and Income Inequality**
Paolo Verme, August 2010.
- 2010-16 **The Poverty Reduction Capacity of Private and Public Transfers in Transition**
Paolo Verme, August 2010.
- 2010-17 **Migration and Culture**
Gil S. Epstein and Ira N. Gang, August 2010.
- 2010-18 **Political Culture and Discrimination in Contests**
Gil S. Epstein, Yosef Mealem and Shmuel Nitzan, October 2010.
- 2010-19 **Governing Interest Groups and Rent Dissipation**
Gil S. Epstein and Yosef Mealem, November 2010.
- 2010-20 **Beyond Condorcet: Optimal Aggregation Rules Using Voting Records**
Eyal Baharad, Jacob Goldberger, Moshe Koppel and Shmuel Nitzan, December 2010.
- 2010-21 **Price Points and Price Rigidity**
Daniel Levy, Dongwon Lee, Haipeng (Allan) Chen, Robert J. Kauffman and Mark Bergen, December 2010.
- 2010-22 **Price Setting and Price Adjustment in Some European Union Countries: Introduction to the Special Issue**
Daniel Levy and Frank Smets, December 2010.
- 2011-01 **Business as Usual: A Consumer Search Theory of Sticky Prices and Asymmetric Price Adjustment**
Luís Cabral and Arthur Fishman, January 2011.
- 2011-02 **Emigration and democracy**
Frédéric Docquier, Elisabetta Lodigiani, Hillel Rapoport and Maurice Schiff, January 2011.