WP/06/231

IMF Working Paper

Barriers to Retail Competition and Prices: Evidence from Spain

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INTERNATIONAL MONETARY FUND

 WP/06/231

IMF Working Paper

European Department

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October 2006

Abstract

Why do prices in Spain's regions fail to converge? The prime suspects for this puzzling result are differences in regional barriers to entry in retail distribution. This paper develops a Cournot-Nash model of imperfect competition to illustrate the effect of barriers on prices. A unique data set—derived from an extensive analysis of competition policies in Spain—provides evidence that barriers to entry increase regional prices. The evidence also suggests that, consistent with the model's predictions, barriers to entry raise prices up to a point, and thus indicate that barriers have a threshold effect on prices.

JEL Classification Numbers: C23, D43, and E3.

Keywords: Barriers to entry, Cournot-Nash model, regulation in goods markets, and panel cointegration.

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[1] The author is grateful to Laura Alfaro, Mario Catalán, Martín Kaufman, Alessandro Rebucci, Antonio Spillimbergo, Evan Turner, Thomas Walters, and Mark Watson for comments; Pavlo Chernyshenko for research assistance; and Arlene Tayas for gracefully putting together the manuscript. Remaining errors are the author's responsibility.

Contents Page

I. INTRODUCTION

Why do prices in Spain's regions fail to converge? Along with persistent differences in wages, the prime suspects for this puzzling result are differences in regional barriers to entry for retail distribution. Aside from reducing real wages, Blanchard and Giavazzi (2003) have argued that regulating product markets or firm entry increases price markups. Empirical evidence of these effects has been provided indirectly from assessments based on survey measures of product market competition (Djankov and others, 2002), on the margin of operating income over sales (Cincera and Galgau, 2005) and on the inverse of the observed share of national income (Neiss, 2001, and Cavelaars, 2003). Recently, barriers to entry have also been found to hinder the creation (and increase the average size) of new firms in Europe (Klapper, Laeven, and Rajan, 2006), which points to a specific channel through which barriers may affect product markets and prices.

The dispersion of barriers to entry across Spain's autonomous regions—reflecting the high degree of regional autonomy afforded by the 1978 Spanish Constitution[2]—makes Spain an ideal candidate to examine the link between barriers and prices. Indeed, the Spanish Tribunal for the Defense of Competition (TDC) warned that regional barriers to entry for large retail establishments have "lowered competition...allowing incumbent firms to be less efficient, which has translated into higher prices" (TDC, 2003, p. 22). This contrasts with the European Single Market Program initiative—launched more than two decades ago—to deregulate markets and lower trade barriers (Nicoletti and Scarpetta, 2003; and Chen, 2004).

This study uses the Cournot-Nash framework of imperfect competition to develop a simple model illustrating the impact of barriers to entry on the price level. In this model, one of the firm types, *traditional retailers*, never faces barriers to entry; the other firm type, *low-cost retailers*, does. The long-run price level is determined by the zero-profit condition (including barrier to entry costs). In the absence of barriers, low-cost retailers drive prices below the traditional retailers' long-run break-even point thereby forcing the latter out of the market. In this model (with nondifferentiated products), the discrete cost advantage of low-cost retailers and the zero-profit condition result in threshold effect: barriers drive up prices to the point where traditional retailers are able to compete with low-cost retailers. Further increases, however, would leave the price level unchanged, as prices are pinned down by the traditional retailers; low-cost retailers would be forced out of the market nonetheless.

The empirical evidence in this study exploits a unique data set derived from an extensive analysis of competition policies in Spain's autonomous regions (TDC, 2003). As discussed below, an ordinal measure of barriers to entry is derived from the seven barriers to retail trade identified by the TDC. The Cournot-Nash model guides the specification of the

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[2] Spanish courts have upheld the view that a regional government's autonomy is limited only by those restrictions spelled out in the Constitution. This interpretation is analogous to that of the U.S. Supreme Court regarding the 10^{th} amendment to the U.S. Constitution.

empirical models, and panel cointegration techniques are employed to estimate the price effect of barriers (Pedroni, 2001).

II. Regional Barriers to Retail Competition in Spain

Although the economic concept of what constitutes a barrier to entry has a rich and controversial heritage, a comprehensive effort by the TDC (TDC, 2003) has identified seven distinct barriers to retail competition at the regional level:

1. defining a large retail firm based on its location;
2. establishing multiple criteria to determine whether a firm is large;
3. defining a firm to be large when at least 25 percent is owned by a large firm;
4. establishing idiosyncratic requirements to license discount stores;
5. restricting the expansion or a change in a firm's ownership;
6. requiring financial viability plans to license commercial establishments; and
7. imposing outright bans on large retail outlets.[3]

These barriers protect incumbent retail establishments from potential competition from large retail establishments or outlets, by either increasing the cost of operating in a particular region, or extending these costs to a broader range of firms. As such, they entail "a cost that must be incurred by a new entrant and that incumbents do not or have not had to incur" (McAfee, Mialon, and Williams, 2004, page 462, definition 8). Note that neither the TDC's analysis nor this study distinguishes between a "primary barrier to entry" (a barrier in its own right; McAfee, Mialon, and Williams, 2004, page 483, definition 10) and an "ancillary barrier to entry" (not a barrier in and of itself, but a reinforcement of other barriers to entry; McAfee, Mialon, and Williams, page 483, definition 11). In this regard, this study follows Djankov and others (2002) and counts the number of barriers in individual regions to obtain an ordinal measure of the barriers to entry.[4]

Although all barriers have been employed by Spain's regions, the two most commonly used are those defining a large firm based on its location (barrier 1) and outright bans (barrier 7).

[3] As elaborated below, an outright ban would fix the number of large retail outlets and thus eliminate the indeterminacy characterizing a coexistence equilibrium. But the effect of bans on prices is not distinguishable from those of other barriers to entry.

[4] Institut Cerdà (2004) derives an alternative (time-invariant) measure of regulation in Spain: a binary variable identifying high- and low-regulation regions derived from a weighted average of five regulation elements that, with the exception of shopping-hour regulations, are analogous to those noted in the main body of the text. In this study, shopping-hour regulations were not included as they have a distinct effect on competition (see Inderst and Irmen, 2005). Also, international borders are not discussed here (see Gil-Pareja and others, 2005 for a recent discussion of border effects).

Both have been present in more than half of the regions during the sample period, 1996–2005 (Table 1). A number of regions—including Aragón, Castilla-León, Cataluña, Galicia, La Rioja, Navarra, and Valencia—have employed location-based restrictions (barrier 1) since the mid-1990s; these have remained in place through end-2005 (Figure 1).[5] With the exception of Baleares and Cataluña, however, outright bans (barrier 7) have sprung up more recently, mostly since 2001. It is noteworthy that, aside from Cantabria, outright bans have been used in tandem with other barriers to entry. This may reflect large firms' ability to circumvent entry bans, including by buying up existing establishments, and may underlie the rationale for specific barriers, such as those defining large firms based on ownership (barrier 3) and restricting ownership changes (barrier 5). Idiosyncratic license requirements for discount stores (barrier 4) have also been used in a number of regions since the late 1990s.

These data suggest that, in contrast with international developments, retail trade has become increasingly regulated in Spain, a trend that aligns closely with price developments. The rising trend in regional barriers to retail competition contradicts the falling trend in international trade barriers among European countries. Indeed, most Spanish regions were barrier free in 1996, but 14 of the 17 regions have imposed at least one barrier since then (Figure 2, top panel). Also, regions that were relatively friendly to retail trade at the outset—Asturias, Cantabria, Extremadura, and País Vasco—have caught up with the more restrictive practices in other regions.[6] Notably, Castilla-La Mancha is the only region that has remained barrier free. The evolution of barriers to entry and that of prices are striking at the national level (Figure 2, bottom panel): a cross-section regression suggests that the (average) increase in the regional barriers to retail competition (1.75) can account for almost four-fifths of the 25 percent increase in the price level since 1996.[7]

While tantalizing, this assessment overstates the role of barriers as it does not control for the effect on prices of overall inflation—a macroeconomic phenomenon. A simple way of controlling for economy-wide effects is expressing prices and barriers as deviations from national trends, that is, subtracting time averages (Figure 3). Even though this transformation imposes the constraint that macroeconomic effects have the same effect in the 17 regions, it helps uncover a more complex interaction between prices and barriers. Specifically, regional time series estimates suggest that the price-barrier relation was not as expected in about half

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[5] The time dimension for each barriers has been derived from the periods when the relevant laws and decrees were in effect (Table A1).

[6] In this study a fraction of a barrier can arise from prorating the number of months within a quarter when a barrier was in effect. For instance, a barrier established in the last month of the quarter would thus correspond to a one-third barrier during that quarter.

[7] Specifically, the ordinary least squares (OLS) slope estimate is 0.11, which translates into a price increase—$\Delta \log P = 0.11 \times \Delta Barrier$—of 19 percent from the increase in barriers.

of the 17 regions: negative slope coefficients were found in four regions (Asturias, Cantabria, Madrid, and La Rioja) and statistically indistinguishable (positive) coefficients in four other regions (Andalucía, Canarias, Castilla-León, and Cataluña). Assessing the impact of barriers on prices would thus appear to require a richer framework.

III. A Cournot-Nash Model with Barriers to Entry

In this study, the analysis of barriers to entry and regional prices is anchored by the Cournot-Nash framework of imperfect competition. Retail services are nontraded so that firms must open a store before generating sales in a specific region. As noted above, the regional retail industry consists of two firm types: *traditional retail shops* that never face barriers to entry, and *low-cost outlets* that do, but possess a cost advantage. Each firm type consists of a number of identical firms maximizing profits by choosing output given other firms' output.[8] Long-run prices are pinned down by the zero-profit condition.

In this setting, barriers to entry have a threshold effect on price. The intuition behind the threshold effect is straightforward. Consider long-run prices when there are no barriers to entry: competition results in prices falling below the long-run break-even price of traditional retail shops, P^{FE}, and thus the market would be supplied only by low-cost outlets. Erecting regional barriers to entry increases the average cost structure of outlets, and long-run prices increase. When barriers have risen to the point where prices reach P^{FE}, traditional retailers can make zero profits while competing against outlets that are handicapped by entry barriers. In other words, at that price (and at that barrier-to-entry level) traditional retailers and outlets would "coexist" in the long-run equilibrium. Further barrier increases do not increase prices, as traditional retailers remain free to enter the market, but outlets exit as their average cost exceeds P^{FE}.[9]

A. Traditional Retail Shops

The firm's problem in the j^{th} region is given by

$$\max_{q_i} \pi_i = P^{(j)}(Q_j)\cdot q_i - c_i \cdot q_i - f_j, \quad i = 1,2,3,\ldots,n \text{ and } j = 1,2,3,\ldots,17,$$

where π, q, c, and f denote profits, output, and marginal and fixed costs for the i^{th} firm; the fixed costs are taken to be the annual costs of operation associated with regulations in the j^{th}

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[8] Consistent with the long-run focus of the model, this setup can be thought to be the second-stage price competition in a model where firms first choose output capacity (Mas-Colell, Whinston, and Green, 1995).

[9] Readers primarily interested in the empirical results can skip to Section IV.

region, including bureaucratic and accounting requirements. $P^{(j)}(Q_j)$ is the j^{th} region's (inverse) demand function, and $Q_j = \sum_{i=1}^{n} q_{i,j}$. The first-order profit-maximizing condition that expresses the equality of marginal revenue to marginal cost is the following:

$$P^{(j)}(Q_j) + \frac{\delta P^{(j)}}{\delta Q_j} \cdot \frac{\delta Q_j}{\delta q_i^*} \cdot q_i^* = \frac{\delta c_i}{\delta q_i^*} ,$$

where q^* denotes the optimum output level; in a Cournot-Nash equilibrium $\partial Q_j / \partial q_i = 1$.

For concreteness, take $P^{(j)}(Q_j) = A^{(j)} - Q_j$, where $A^{(j)}$ positions the j^{th} region's (inverse) demand curve, and assume that all traditional firms are identical. The symmetrical Cournot-Nash optimal output can thus be expressed as

$$q_i^* = \frac{1}{1+n} \cdot \left(A^{(j)} - c_i \right),$$

which depends on the endogenous number of firms, n, supplying the market.

The zero-profit condition pins down the number of firms in the long run, and thus allows the long-run optimum level of output to be characterized fully. In this connection, entry can be thought to be a two-stage process: a firm incurs an entry cost f, and then competes for business; there are no strategic effects nor first-mover advantage. A firm thus enters whenever profits in the second stage cover the entry cost; the resulting number of firms supplying the market can be expressed as[10]

$$n^{FE} = (A^{(j)} - c_i) \Big/ \sqrt{f_j} - 1,$$

which, in turn, implies that the optimum output level and free-entry price are

$$q_i^{FE} = \sqrt{f_j} \text{ , and } P_j^{FE} = c_i + \sqrt{f_j} \ .$$

This equilibrium represents the pure-strategy subgame-perfect Nash equilibrium, as no firm would change its entry decision given the entry decision of other firms (see Mas-Colell, Whinston, and Green, 1995, Chapter 12.E). Note that, without barriers, long-run price equilibriums across regions will converge up to differences in marginal and fixed costs.

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[10] This follows from the fact that prices equal the average cost when profits equal zero: $A^{(j)} - n^{FE} \cdot q_i^* = c_i + f \,/ q_i^*$. The expression in the main body of the text results from plugging in the optimal level of output, and solving for n^{FE} .

For the discussion that follows, it is important to draw attention to the effect of an increase in fixed costs on the long-run equilibrium: prices increase because, even though output (per firm) rises,

$$\frac{\delta q_i^{FE}}{\delta f_j} = \frac{1}{2\sqrt{f_j}} = \frac{1}{2q_i^{FE}} > 0$$

this does not fully offset the supply lost from firms exiting the market,

$$\frac{\delta n^{FE}}{\delta f_j} = -(1+n^{FE}) \cdot \left(\frac{1}{2q_i^{FE}} \right)^2 < 0 \ ,$$

and thus overall output declines

$$\frac{\delta Q^{FE}}{\delta f_j} = \frac{\delta (n^{FE} \cdot q_i^{FE})}{\delta f_j}$$
$$= \left[n^{FE} \cdot \frac{\delta q_i^{FE}}{\delta f_j} + q_i^{FE} \cdot \frac{\delta n^{FE}}{\delta f_j} \right]$$
$$= -\frac{1}{2q_i^{FE}} < 0.$$

Note also that a decline in marginal costs, c, lowers prices because the number of firms increases and the output per firm remains unchanged.

B. Low-Cost Outlets

No regional barriers to entry

Consider next the Cournot-Nash equilibrium in the absence of regional barriers when low-cost outlets are part of the retail fabric. By assumption, the only difference between traditional and low-cost firms is the marginal cost, which is lower by a constant, ς. Using the expressions discussed above, the Cournot-Nash equilibrium would be characterized by lower prices, $\tilde{P}_j^{FE} = P_j^{FE} - \zeta$, which result from a larger number of low-cost outlets, $m^{FE} = n^{FE} + \zeta \big/ \sqrt{f_j}$, each supplying the same amount as traditional retailers, $\tilde{q}_j^* = q_i^* = \sqrt{f_j}$. Since $P<P_j^{FE}$, traditional shops are not part of the retail fabric in the long run.

Regional barriers to entry

Barriers are modeled as a fixed cost—akin to an annual licensing fee—that shifts an outlet's average cost structure. As noted above, the profit-maximizing behavior and entry decision imply that barriers reduce the number of firms in the market but increase the level of output (per firm) of the firms remaining in the market.[11] Specifically, let $\lambda^{(j)}$ denote the j^{th} region's barrier to entry; then the relation between barriers and the overall level of output—the number of firms, *m*, times the optimal firm-level output—can be expressed as

$$\begin{aligned} Q &= m \cdot \tilde{q}_k^* \\ &= \left(\frac{A^{(j)} - (c_i - \varsigma)}{\sqrt{f_j + \lambda^{(j)}}} - 1 \right) \cdot \left(\sqrt{f_j + \lambda^{(j)}} \right) \\ &= A^{(j)} - (c_i - \varsigma) - \sqrt{f_j + \lambda^{(j)}}, \end{aligned}$$

which, combined with the (inverse) demand, renders the relation between the price level and barrier $\lambda^{(j)}$ to be as follows

$$\frac{\delta P^{(j)}}{\delta \lambda^{(j)}} = \frac{1}{2 \cdot \sqrt{f_j + \lambda^{(j)}}} > 0, \quad \text{if } P < P_j^{FE}.$$

As discussed above, prices increase because the decline in the number of firms is not fully offset by the greater output supplied by the firms remaining in the market; the impact on prices, however, declines as barriers increases.

C. Coexistence Equilibrium

As noted above, traditional and low-cost retailers will both supply the market, and thus coexist, when barriers to entry are such that low-cost outlets achieve zero profits precisely at $P = P_j^{FE}$. To analyze this case, the profit-maximization problem is revised to account for the fact that the market is now supplied by both firm types; given the optimizing behavior, it is possible to characterize the specific barrier that supports this equilibrium.

The profit-maximization problem for the low-cost outlet can be expressed as

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[11] Increases in output per firm are consistent with Klapper, Laeven, and Rajan (2006) who find that barriers increase the average firm size in Europe.

$$\max_{\tilde{q}_k} \tilde{\pi}_k = P^{(j)}(Q)\cdot \tilde{q}_k - (c_j - \zeta)\cdot \tilde{q}_k - (f_j + \lambda^{(j)}), \quad k = 1,2,3,\ldots,m \text{ and } j = 1,2,3,\ldots,17$$

where m is the number of low-cost outlets, and $Q = \sum_{i=1}^{n} q_i + \sum_{k=1}^{m} \tilde{q}_k$; a tilde denotes low-cost outlets' variables. For their part, traditional retailers' profit maximization remains unchanged but Q now aggregates output of both firm types.

The symmetric Cournot-Nash solution for profit-maximizing firms results in the following reaction functions

$$q_i^* = \frac{1}{1+n}\cdot\left(A^{(j)} - c_i - m\cdot\tilde{q}_k^*\right), \qquad \tilde{q}_k^* = \frac{1}{1+m}\cdot\left(A^{(j)} - (c_i - \varsigma) - n\cdot q_i^*\right),$$

which are met simultaneously in equilibrium implying that the optimal output levels can be expressed as[12]

$$q_i^* = \frac{1}{1+n+m}\cdot\left(A^{(j)} - c_i - m\cdot\varsigma\right), \qquad \tilde{q}_h^* = \frac{1}{1+n+m}\cdot\left(A^{(j)} - c_i + (1+n)\cdot\varsigma\right).$$

As above, fully characterizing the long-run optimal level of output requires pinning down the number of firms supplying the market. Specifically, since $P{=}P_j^{FE}$, which in turn can be expressed as

$$P_j^{FE} = A^{(j)} - n^{CO}q_i^* - m^{CO}\tilde{q}_h^*$$

where $P_j^{FE} = c_i + \sqrt{f}$ and using the expression for the optimal output levels derived above and solving for n results in the following expression

$$n^{CO} = n^{FE} - \left(1 + \varsigma \Big/ \sqrt{f_j}\right)\cdot m^{CO}.$$

In words, the number of traditional firms in the coexistence equilibrium, n^{CO}, equals that of the free-entry equilibrium adjusted downward by the number of low-cost outlets. Even though this expression reflects the differing optimum output levels associated with firm

[12] Note that in the coexistence equilibrium, the difference between the output of low-cost and traditional retailers, $\tilde{q}_k^* - q_i^*$, equals the cost advantage, ς, and thus does not depend on the size of the market.

type—the number of traditional firms declines by more than the increase in the number of outlets—the precise number of each firm type is undetermined.[13] Still, this relation can be used to determine the optimum output levels, which are as follows

$$q_i^* = \sqrt{f_j}, \qquad \tilde{q}_k^* = \sqrt{f_j} + \varsigma,$$

and thus the barrier supporting the coexistence equilibrium can be expressed as

$$c_i + \sqrt{f_j} = (c_i - \varsigma) + (f_j + \lambda^{CO}) / \tilde{q}_k^*,$$
$$\lambda^{CO} = \varsigma^2 + 2 \cdot \varsigma \cdot \sqrt{f_j}.$$

Note that λ^{CO} increases with the cost advantage of low-cost retailers and with the (nonbarrier-related) fixed cost. If the regional barrier exceeds the coexistence level (for that region), low-cost firms are unable to make a profit and exit the market; prices remain unchanged, however.

In sum, the model predicts a threshold effect of barriers to entry on prices: barriers to entry will increase prices as long as the barrier remains below λ^{CO} ($P<P_j^{FE}$); raising the barrier higher leaves prices unchanged but drives the low-cost retailers out of the market.[14,15]

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[13] An outright ban on low-cost firms (barrier 7) would in principle fix m^{CO} and, hence, pin down n^{CO}. In practice, low-cost firms may jump the bans by buying incumbents.

[14] In Blanchard and Giavazzi (2003), barriers to entry—by reducing the number of firms—increase prices (markups), but a threshold does not arise because firms share a common technology and products are differentiated. Although multiple thresholds could emerge if the market were populated by several firm types each with a cost advantage over the previous type and facing different entry costs. In practice, this is unlikely as it would require regional governments to be able to identify firm types and impose barriers accordingly.

[15] An analogous “threshold” effect has been discussed in the international trade literature as the “water in the tariff” result: imports do not decline further when a tariff reaches a prohibitive level.

IV. Empirical Evidence[16]

The model suggests that long-run prices will depend on wages and fixed costs, as well as barriers to entry, all of which may reflect idiosyncratic regional differences. Also, the ordinal measure of barriers used in this study could obscure the potential differing impact on prices associated with a specific barrier (or barriers) that are prevalent in each region. To accommodate this heterogeneity, the panel estimation technique employed groups the "between dimension" estimates of the panel (group mean estimators), making possible hypothesis testing without an assumption of a common (regional) value under the alternative hypothesis. Pesaran and Smith (1995) argue that when the slope coefficients are heterogeneous—as expected in this study—group mean estimators will provide consistent point estimates of the sample mean of the heterogeneous cointegrating vectors; pooled within-dimension (fixed-effects) estimators would not. The estimates discussed below follow Pedroni (2001) who generalizes Stock and Watson (1993) DOLS estimation to panel data.

A. Linear Relation

A useful starting place for the empirical analysis is the linear model, even though the coefficient estimates will be biased downward if a threshold effect characterizes the data. The linear specification of the price equation can be expressed as

$$p_{j,t} = \mu_{j,t} + \beta_{1,j} \cdot w_{j,t} + \beta_{2,j} \cdot Barriers_{j,t}$$

$$j = 1, 2, 3, \ldots, 17 \,,$$

$$\mu_{j,t} = \beta_{0,j} + \kappa_t + \varepsilon_{i,t}$$

where *Barriers* is the ordinal measure of barriers to entry described in Section II, and ε is a white noise error term with the usual properties. Note that time-invariant regional idiosyncratic features determining prices—including variables such as transaction and other fixed costs—and common (economy-wide) effects are captured by the intercept, $\beta_{j,0}$ and the time effects, κ_t, terms. The linear model is estimated using panel DOLS—time averages are subtracted from the time series to avoid nuisance parameters (Pedroni, 1999)—where the dependent variable is the regional consumer price index (CPI); in turn, its eight subcomponents (for details of the price series, see Table A2) also serve as the dependent variable in the regression.

As anticipated, the relation between prices and barriers to entry is tenuous (Table 2). Point estimates for CPI suggest that adding barriers increases prices slightly in the long run, if at all. Estimates for price subcomponents exhibit substantial variation, however, with the largest

[16] Table A2 describes the data. See the Appendix for a discussion of regional price index convergence and cointegration.

effect (per barrier) uncovered in *Transportation and Communications* and *Other* (0.4 percent).[17] An intriguing result is the sign reversal found in several price subcomponents—namely, housing, household items, and medicine and health—where barriers are associated paradoxically with lower prices.[18] Note that these estimates cointegrate (see Appendix), and, to a large extent, mirror the patterns uncovered by the simple correlations noted above (Figure 3).[19]

Whether outright bans (barrier 7) have a distinct effect on prices can be examined by extending the linear model. Specifically, consider the following model:

$$p_{j,t} = \beta_{1,j} \cdot w_{j,t} + \beta_{2,j} \cdot \widetilde{Barriers}_{j,t} + \beta_{3,j} \cdot Ban_{j,t} + \mu_{j,t}$$
$$j = 1, 2, 3, \ldots, 17,$$
$$\mu_{j,t} = \beta_{0,j} + \kappa_t + \varepsilon_{i,t}$$

where $\widetilde{Barriers} \equiv Barriers - Ban$ and *Ban* takes on the value of one when a ban is in place; the assumptions made regarding the rest of the model remain as above. Note that by fixing the number of low-cost outlets, bans could have a larger impact on prices ($\beta_2 > \beta_3$), in practice, however, this might not hold true. This is because low-cost outlets have an incentive—non-zero profits—to circumvent the ban, for instance, by buying into the market, and thereby mitigating the effect of bans.

The empirical evidence from the extended model suggests that the impact of bans and other barriers on prices are indistinguishable (Table 3). In particular, the null hypothesis $H_0 : \beta_2 = \beta_3$ cannot be rejected at conventional significance levels as the p-value exceeds 0.10 in all regressions. A puzzling result emerges, however, as a perverse effect of bans is found in a number of price subcomponents; taking this result literally would imply that prices fall when bans are imposed. In sum, the empirical evidence from linear models points to a number of puzzling, or perverse, effects of barriers to entry on prices.

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[17] Since *Barriers* appears in the estimated equation in levels but p_j measures log levels of prices, the percent increase in prices from changes in retail barriers is computed as the exponential of the estimated coefficient minus 1 times 100.

[18] Arnone and Scalise (2005) suggest that deregulation in good markets (with heterogeneous firms) could result in perverse price effects when the initial degree of regulation is high.

[19] Regarding the price elasticity with respect to wages, it is also low mostly due to the fact that macroeconomic trends are not included in these estimates.

B. Threshold Estimates

The simplest way to capture the Cournot-Nash model's threshold effect is as follows:

$$p_{j,t} = \beta_{1,j} \cdot w_{j,t} + \beta_{2,j} \cdot I_{j,t}(Barriers_{j,t} \geq 1) + \beta_{3,j} \cdot I_{j,t}(Barriers_{j,t} \geq 2) + \cdots + \mu_{j,t}$$

$$\mu_{j,t} = \quad \beta_{0,j} + \kappa_t + \varepsilon_{j,t}$$

where $I_{j,t}(\cdot)$ corresponds to an indicator variable for the jth region. In this setup, the indicator variables capture the effect of barriers on prices as a step function. Thus, $\beta_{2,j}$ measures the effect of barriers when one or more are imposed, $\beta_{3,j}$ gauges the effect of barriers when two or are imposed, and so on. In this model, the estimate for the threshold stems from the condition governing the highest significant indicator variable. For instance, if $\beta_{2,j}$ is statistically significant but higher $\beta_{h,j}$'s (h≥2) are not, then the estimated threshold would be one single barrier.

The empirical evidence supports the threshold effect predicted by the Cournot-Nash model (Table 4). First, β_2 is statistically significant but β_3 is not.[20] And thus, the estimated threshold is one: prices react to the first barrier but not to additional barriers. Evidence for the entertainment and other price subcomponents, however, suggest that the effect of the second barrier is not zero at the 5 percent marginal significance level. Second, the estimated effect of barriers on prices rises sharply when thresholds are accommodated. Specifically, β_2—the effect of imposing one or more barriers—increases tenfold in Model 1 compared to estimated coefficient in the linear model. Although the estimated effect falls when β_3 is excluded in Model 2, nonetheless, it remains larger than in the linear model. And third, with the exception of CPI—reflecting the evidence from the medicine and health subcomponent—the perverse effects of barriers vanish in the panel estimates.

[20] Threshold values were restricted to positive integer values 1 and 2 as fractional values arise only in the single quarter when the barrier is either created or removed. Note that higher thresholds values were not included as these would be estimated with a small fraction of the sample. Also, a zero threshold value was not considered because it would imply that barriers do not affect prices; the empirical evidence suggests otherwise (Tables 2 and 3). Also, in the Cournot-Nash model a zero threshold implies that traditional retailers and low-cost outlets share a common marginal cost. If so, low-cost outlets would, however, be indistinguishable from traditional shops and the rationale (and ability) to impose barriers to entry vanishes.

Although barriers have a statistically significant effect on prices, the magnitude of effect is small. In part, as noted above, this reflects the fact that the measured effect is constrained to the non-economy-wide effect of the barrier. In other words, the time dummies in the empirical model soak up indiscriminately the economy-wide price effects of barriers. But also, substantial variation lies beneath the panel estimates (Figure 4). Large effects—both positive and, more puzzling, negative—were uncovered in all price subcomponents.

V. Conclusion

In contrast with the evidence in the United States and Europe, regional price indices in Spain do not converge. Persistent differences in price indices might reflect a lack of absolute price convergence, but could also be due to prices that differ by a constant or that increase by differing rates (Engel and Rogers, 2001). Still, price convergence emerges in Spain once regional barriers to entry have been accounted for. Barriers to retail competition in Spain thus generate a persistent differentiated cost wedge across regions; a result reminiscent of the trade costs solution to the PPP puzzle in international trade (Obstfeld and Rogoff, 2000).

A Cournot-Nash model of imperfect competition was developed to model the retail industry—composed of traditional shops and low-cost outlets—and used to analyze the effect of barriers to entry on prices. In this setting, barriers to entry have a threshold effect on prices resulting from differences in technology and the long-run zero-profit condition. Specifically, prices will increase when barriers are imposed on low-cost establishments, as long as the market is supplied by these firms alone. If barriers exceed a threshold level—determining a coexistence equilibrium where both low-cost and traditional firms supply the market—prices will not rise further. This is because traditional shops, which remain free to enter, pin down prices to the level resulting in zero profits; still, low-cost outlets would exit the market.

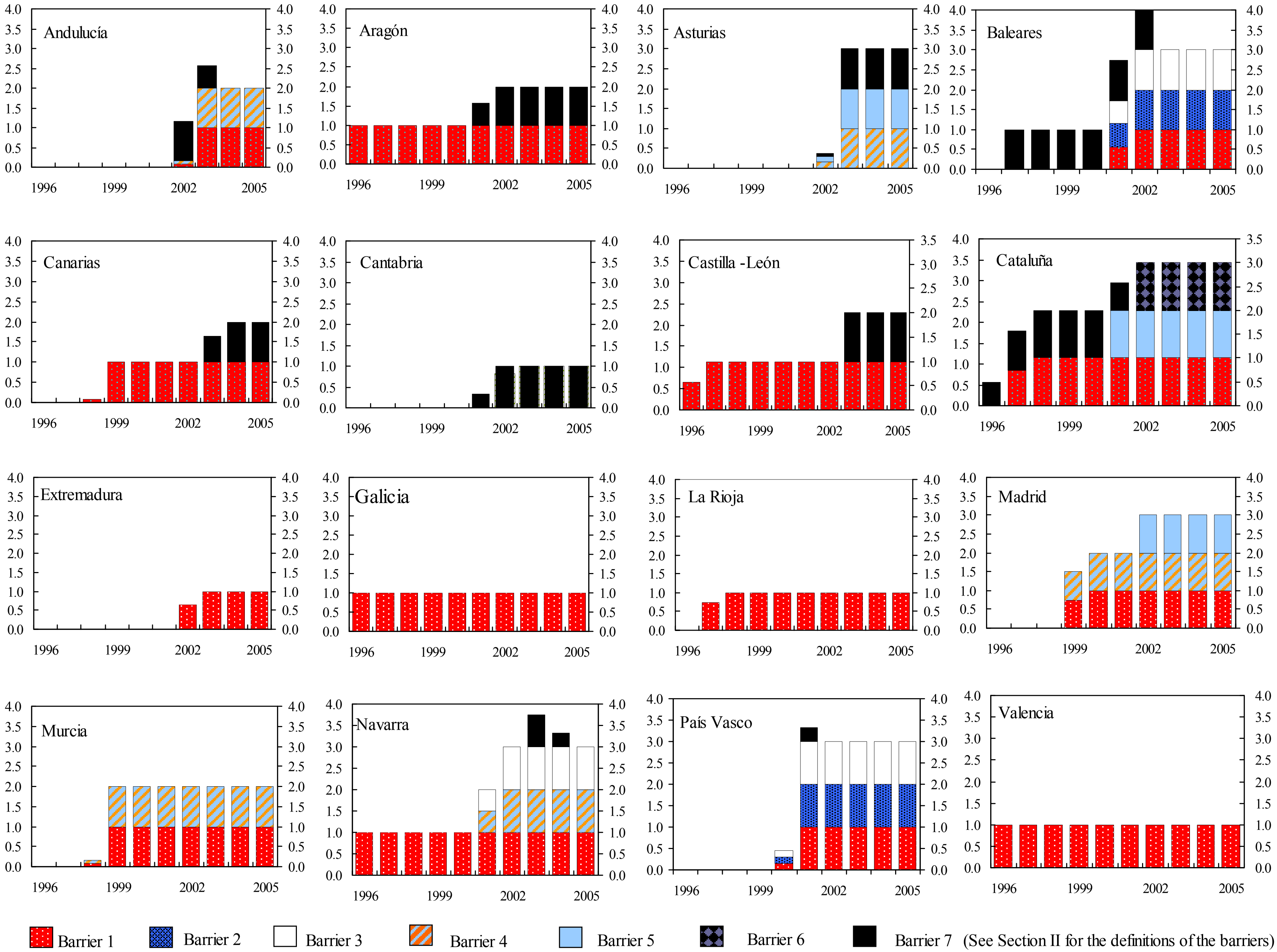
Consistent with the prediction of the Cournot-Nash model, the empirical evidence—using a unique data set derived from an exhaustive study of regional competition policies—suggests that a threshold characterizes the effect of barriers on prices. Moreover, the data suggest a threshold value of one, that is, imposing a second or third barrier does not increase prices further. Although care is needed in interpreting this result, it would be consistent with a signaling effect of establishing entry barriers. Imposing a single barrier would seem to send a clear protectionist message. Why have regions therefore chosen to impose additional barriers? The Cournot-Nash model suggests that doing so forces low-cost outlets out of the market—at no additional cost in terms of higher prices—and thus changes the composition of the retail industry in favor of traditional shops. To the extent that these shops are locally owned and operated, regional governments may thus be seeking to protect and further employment in these businesses, as well as to shore up electoral constituencies. The available evidence from Europe suggests that barriers have tended to increased the average size of new firms (Klapper, Laeven, and Rajan, 2006), a result that is consistent with the Cournot-Nash model but seemingly at odds with the intent to favor traditional shops.

Even though accounting for the threshold effect strengthens the estimated effect of barriers on prices, the effect remains small. In part, this is because price indices can obscure the effect of barriers on individual prices. Some evidence of this difficulty can be gleaned by comparing the effect of barriers on CPI versus its main subcomponents: the latter are typically larger. Also, this study focuses on long-run effects, which are likely to be smaller than those in the short run. The effectiveness of barriers to entry will tend to erode over time as firms circumvent restrictions. Future research could assess the effect of barriers using individual prices series—which were unavailable for this study—and delve into the dynamic impact of barriers.

More fundamentally, the estimated price effect of barriers excludes, by construction, economy-wide effects, and thus ignores the potential impact of imitating neighbors' restrictive policies. By design, the estimation procedure—namely, including time effects—filters common effects of rising barriers across Spain's autonomous regions. Dropping these effects would not solve the problem, and would introduce nuisance parameters in the estimation (Pedroni, 1999). Instead, a more fruitful avenue for research would be to extend the Cournot-Nash model to account for the fact that firms exiting a region may choose to relocate, and thereby place downward pressure on prices in neighboring regions. This extension could help explain the puzzling negative effects of barriers, as well as capture spillover effects that may underlie a regional government's incentive to imitate its neighbors' restrictive practices.

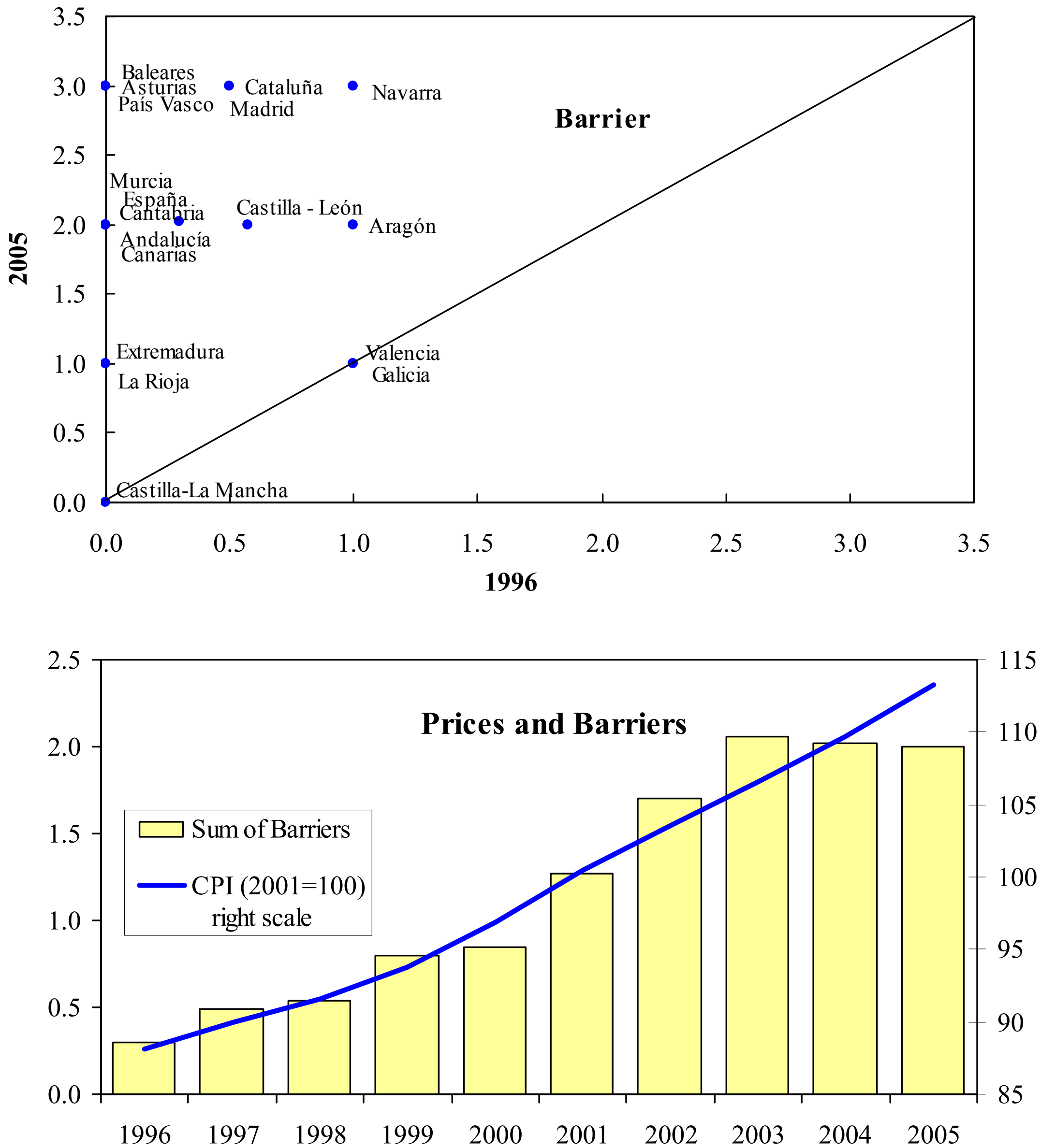
Subnational barriers to entry may also affect regional inflation rates. Imposing barriers, and thereby reducing competition, not only tends to increase price levels, but can also lower the flexibility of prices (and wages). It is through this channel—operating in the opposite direction, that is, increasing competition—that globalization is thought to have contributed to global disinflation (Rogoff, 2003). Conceptually, the transmission mechanism relies on an improvement in the inflation-output trade-off facing a central banker, who stabilizes output in a Barro-Gordon world. Imposing subnational barriers would have the reverse effect: raising barriers to entry would increase inflation by reducing competition and worsening the inflation-output trade-off. However, the Barro-Gordon framework would be hard pressed to explain subnational differences in inflation because monetary policy is common across regions. In this connection, nonetheless, others have argued that differences in product market competition are "more important than any other factor in explaining the differences in inflation rates" in OECD countries and, more tellingly, in EU-15 members (Cavelaars, 2003, page 71), which to a large extent share a common monetary policy. It is an open question, however, whether subnational barriers to entry in Spain have contributed to those differences.

Figure 1. Evolution of Barriers by Region, 1996–2005



Source: Tribunal de Defensa de la Competencia (TDC, 2003).

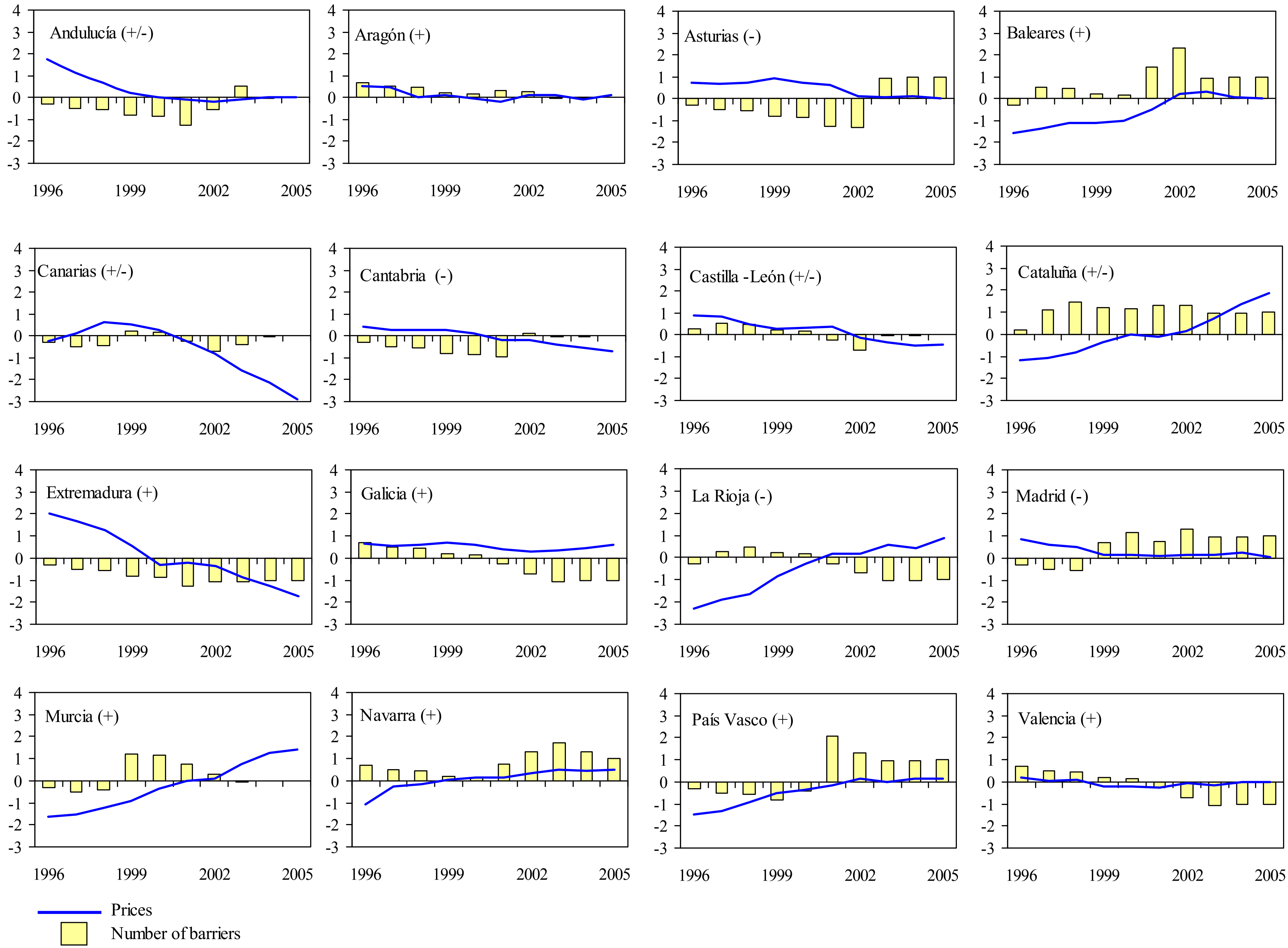
Figure 2. Evolution of Barriers and Prices in Spain, 1996–2005



Source: Tribunal de Defensa de la Competencia (TDC, 2003); and Instituto Nacional de Estadística (INE).

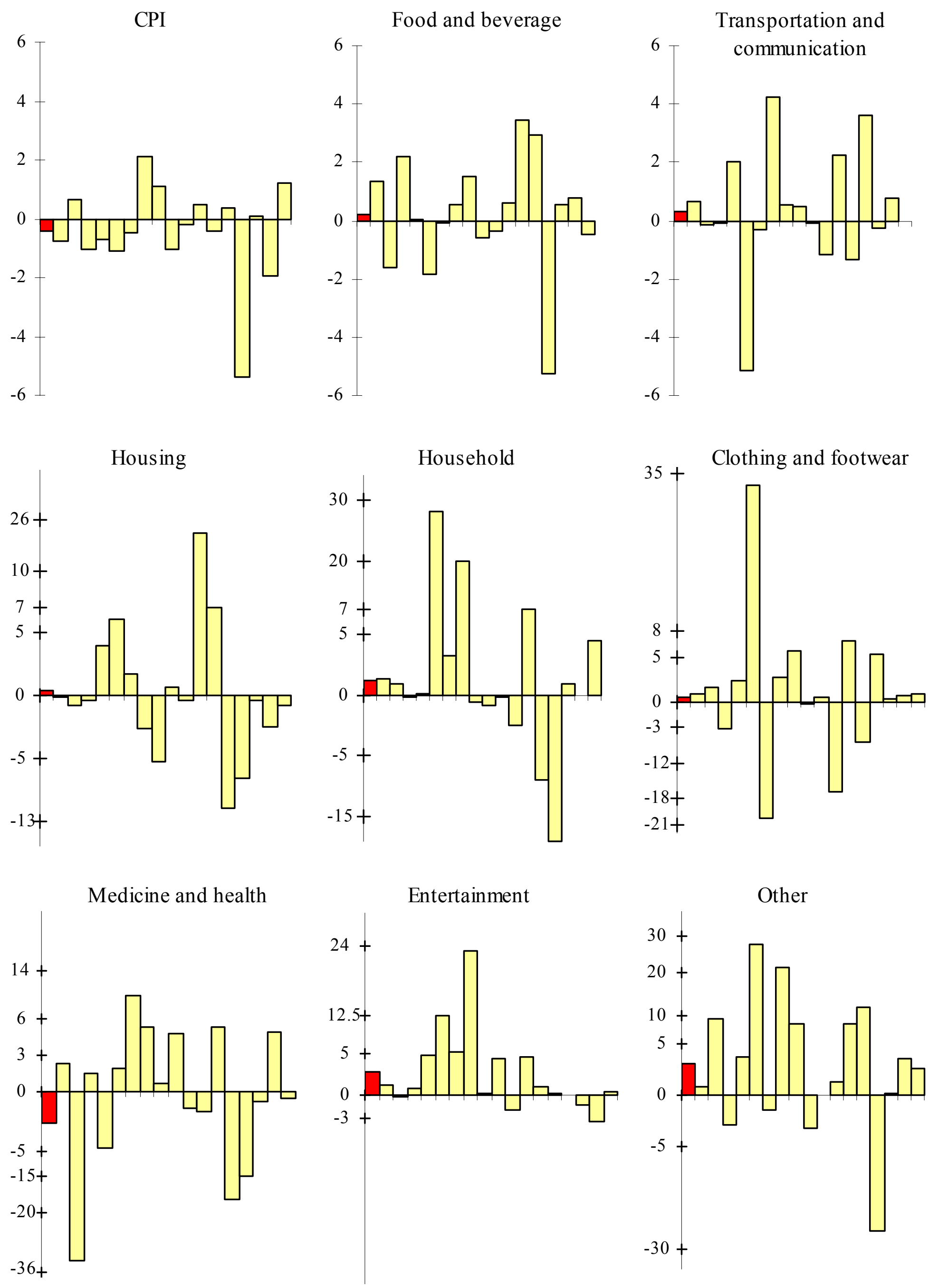
Figure 3. Barriers and Prices by Region, 1996–2005

(Prices and barriers expressed as differences from national averages; signs of simple regression slope indicated in parenthesis)



Source: Tribunal de Defensa de la Competencia (TDC, 2003) and Instituto Nacional de Estadística (INE).

Figure 4. Price Effects by Region (In percent)



Source: Tables 4 and A4.

Note: The price effect is calculated as the exponential of the coefficient estimate on barriers minus 1, expressed as a percent.

Table 1. Legal Barriers to Retail Distribution by Region, 1996–2005

	Type of barrier						
	Location definition of large firm	Multiple criteria to define large firms	Ownership definition	Idiosyncratic definition of large firm	Restriction in the transfer of ownership	Financial viability plan	Outright ban
	1	2	3	4	5	6	7
Andalucía	x			x			x
Aragón	x						x
Asturias				x	x		x
Baleares	x	x	x				x
Canarias	x						x
Cantabria				x			x
Castilla-La Mancha							
Castilla-León	x						x
Cataluña	x				x	x	x
Madrid	x			x	x		
Valencia	x						
Extremadura	x						
Galicia	x						
La Rioja	x						
Murcia	x			x			
Navarra	x			x	x		x
País Vasco	x	x	x				x
Total number of regions imposing each type of barrier	14	2	2	6	4	1	10

Source: Tribunal de Defensa de la Competencia (TDC, 2003).
Note: The symbol "x" denotes whether a specific regions has imposed the barrier type listed in the column header at some time during the period 1996–2005.

Table 2. Cointegrating Vector Estimates

Dependent Variable	Right-Hand-Side Variable			
	Wages		Barriers	
	Coefficient	*t*-Stat	Coefficient	*t*-Stat
CPI	0.129	5.57 **	0.000	0.50
Food and beverages	0.198	8.29 **	0.000	-0.55
Clothing and footware	0.343	9.14 **	0.002	1.29
Housing	0.026	0.58	-0.004	-4.82 **
Household items	0.106	1.99 **	-0.003	-2.39 **
Medicine and health	0.262	4.76 **	-0.007	-4.63 **
Transportation and communication	-0.032	-2.22 **	0.004	6.47 **
Entertainment	0.109	2.41 **	0.002	1.13
Other	0.150	2.04 **	0.004	2.21 **

Note: * (**) denotes rejection of the null hypothesis at the 10 (5) percent significance level. Estimates are obtained by applying DOLS to the individual regional data (Table A3 contains the estimates by region) ; leads and lags are determined by testing down from 3.

Table 3. Bans and Other Barriers

Dependent Variable	Right-Hand-Side Variable						F-test (p-value)
	Wages		Other Barriers		Bans		
	Coefficient	*t*-Stat	Coefficient	*t*-Stat	Coefficient	*t*-Stat	
CPI	0.145	6.61 **	0.005	6.87 **	-0.010	-7.95 **	0.13
Food and beverages	0.279	7.22 **	0.002	1.40	-0.008	-4.11 **	0.40
Clothing and footware	0.667	7.98 **	-0.007	-1.97 *	-0.006	-1.89 *	0.20
Housing	0.069	1.09	-0.001	-0.70	-0.005	-1.64	0.40
Household items	0.094	1.05	0.022	8.56 **	-0.012	-2.47 **	0.18
Medicine and health	0.076	0.75	0.014	4.01 **	0.008	2.16 **	0.20
Transportation and communication	-0.046	-1.37	0.005	4.85 **	0.003	2.84 **	0.26
Entertainment	0.175	3.32 **	-0.002	-0.66	0.007	1.55	0.23
Other	-0.227	-2.03 **	0.018	7.42 **	-0.029	-5.94 **	0.20

Note: * (**) denotes rejection of the null hypothesis at the 10 (5) percent significance level. For details of the estimation see Table 2. Seven regions were excluded from the panel because these regions did not impose a ban, and thus the effect of a ban is unidentified in those regions. The F-test corresponds to the null hypothesis that the coefficients of bans and other barriers are common.

Table 4. Threshold Models

Dependent Variable	Model 1						Model 2					
	Wages		*I*(Barriers ≥ 1)		*I*(Barriers ≥ 2)		Wages		*I*(Barriers ≥ 1)		Price effect	
	Coefficient	*t*-Stat	Coefficient	*t*-Stat	Coefficient	*t*-Stat	Coefficient	*t*-Stat	Coefficient	*t*-Stat	(In percent)	
Panel estimates (MGE):												
CPI	0.074	3.21 **	0.004	2.03 **	0.001	0.54	0.068	3.15 **	-0.004	-5.47 **	-0.4	
Food and beverages	0.124	3.79 **	0.010	2.75 **	0.024	1.73 *	0.073	2.53 **	0.002	0.80	0.2	§
Clothing and footware	0.327	6.05 **	0.021	3.52 **	-0.033	-1.76 *	0.234	4.34 **	0.004	0.69	0.4	§
Housing	-0.096	-1.95 *	0.004	0.97	-0.006	-0.39	0.004	0.13	0.004	1.42	0.4	
Household items	0.070	1.45	0.006	1.46	-0.018	-1.08	-0.190	-3.18 **	0.011	2.40 **	1.1	
Medicine and health	-0.254	-1.53	-0.015	-1.03	0.035	0.59	-0.059	-0.98	-0.026	-3.28 **	-2.6	
Transportation and communication	-0.084	-2.24 **	0.010	2.33 **	-0.021	-1.36	-0.038	-2.49 **	0.003	1.95 *	0.3	
Entertainment	-0.407	-4.15 **	0.119	9.41 **	-0.144	-5.61 **	0.217	4.89 **	0.028	6.22 **	2.8	§
Other	0.516	6.25 **	0.017	2.20 **	0.093	3.61 **	0.190	3.70 **	0.030	5.73 **	3.1	§

Note: * (**) denotes rejections of the null hypothesis at the 10 (5) percent significance level. For details of the estimation procedure see Table 2. The symbol § denotes regressions where I(Barriers ≥ 2) was excluded in Model 2 although it is statistically significant in Model 1. The price effect is calculated as the exponential of the coefficient estimate on barriers (which are measured in levels) minus 1, and expressed as a percent. For instance, the impact on CPI is calculated as (exp(-0.004)-1) times 100.

Regional Price Index Convergence

Regional prices fail to converge *unconditionally* if the pairwise differences in prices across regions are integrated. Letting $p_{j,t}$ denote the (log) price level in the j^{th} region, price divergence can be expressed by the following hypothesis:

$$H_0 : p_{j,t} - p_{k,t} \sim I(1), \quad \forall\ j, k = 1, 2, 3, \ldots, 17.$$

Since Spain has 17 autonomous regions, this expression involves 136= (17×16)/2 bilateral unit root tests. Evans (1998) shows that these multiple tests for a lack of *crossmember* cointegration can be examined with a single panel unit test, namely:

$$H_0 : p_{j,t} - \overline{p}_t \sim I(1),$$

where $\overline{p}_t$ is the mean price level across regions at time *t*.[21] In this connection, standard panel unit tests—Levin, Lin, and Chu (2002), and Im, Pesaran, and Shin (2003)—can be used to test regional price convergence.[22] Similarly, price convergence *conditional* on wages ($x=w_{j,t}$) or on barriers ($x=barriers_{j,t}$) can be tested by the following:

$$H_0 : (p_{j,t} - \overline{p}_t) - \beta_i (x_{j,t} - \overline{x}_t) - \alpha_j \sim I(1),$$

or equivalently by:

$$H_0 : (p_{j,t} - \beta_j x_{j,t}) - \gamma_t - \alpha_j \sim I(1),$$

where $\gamma_t \equiv \overline{p}_t - \beta_j \overline{x}_t$, and α_j are time effects and idiosyncratic (time-invariant) features determining regional prices. These would include topographical features, infrastructure, and so on. In other words, this test would account for differences in transportation costs—typically proxied by geographical distance—that have been helpful in explaining the slow pace of price convergence in the United States (see Parsley and Wei, 1996; Engel and Rogers, 2001; Cecchetti, Mark, and Sonora, 2002; and O'Connell and Wei, 2002).

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[21] This can be verified by noting that the sum (over j) of the pairwise differences divided by *n* would also be distributed I(1). Specifically, $\frac{1}{n}\sum_j (p_{i,t} - p_{j,t}) = \frac{1}{n}\sum_j p_{i,t} - \frac{1}{n}\sum_j p_{j,t}$ or simply, $p_{i,t} - \overline{p}_t$, which is also an I(1) variable. Pedroni and Yao (2005) used this test to study income convergence in Chinese regions.

[22] For a discussion of how these tests compare with earlier tests, see Maddala and Wu (1999).

Panel unit root tests confirm that neither CPI nor wages converges unconditionally across Spain's regions (Table A5).[23] This result is consistent with the persistence of price differences reported in Institut Cerdà (2004), which examines unit root tests applied to the ratio of regional price indices to the national price index. Still, the tests for individual regions contain some evidence of price index convergence. Taken literally, these results suggest that prices in a few regions—Andalucía, Madrid, Valencia, and Navarra—and those in the other 16 regions converge unconditionally (up to an arbitrary constant). Regarding regional wages, panel tests fail to reject nonconvergence, but two individual tests—Cantabria, and País Vasco—indicate some evidence of unconditional wage convergence. Literally, this would imply that although economy-wide geographical labor mobility may be limited, in these regions it appears to be higher and thus enable wage convergence.[24]

Conditional price convergence tests support three alternative hypotheses regarding the lack of price convergence: differences in either wages or barriers to entry, or in both explain the persist differences in prices across regions. The panel evidence does not favor a particular hypotheses: all reject the lack of conditional price convergence at the 1 percent significance level (Table A6). And although a few individual regions' test results differ—for instance, Asturias and La Rioja do not converge when prices are conditioned on barriers to entry—most exhibit a high degree of correspondence.

Still, the introduction of regional barriers to retail competition in the late 1980s appears to have changed the time series properties of prices in Spain. Panel unit root tests using price data before regional barriers to entry emerged in Spain in the late 1980s provide more evidence of price convergence (rejection of the null of unit root) than the subsequent period (Table A7). Specifically, 10 of the 17 regions reject a unit root before barriers were introduced, but only Asturias rejects the hypothesis of a unit root in the more recent period. Additional tantalizing evidence stems from tests on price sub-groups before and after barriers emerged in Spain: five of the eight sub-groups reject a unit root before barriers were introduced. Unfortunately, the competing hypothesis that changes in regional wage behavior might underlie the changes in price developments cannot be tested as regional wage data are not available for the earlier period.

[23] The maximum lags included in the individual regional unit root tests are obtained by testing down for the longest significant lag starting at three lags; DOLS estimates discussed in the main text also test down from a maximum of three lags and leads.

[24] For recent discussion of labor mobility in Spain, see Antolín and Bover (1997), Bentolila (2001) and Amuedo-Dorantes and de la Rica (2005).

Table A1. Barriers to Retail Competition, 1996–2004

Region	Type of Barrier 1/						
	Location definition of large firm	Multiple criteria to define large firms	Ownership definition	Idiosyncratic definition of large firm	Restriction of transfer of ownership	Financial viability plan	Outright Ban
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Andalucía	Articles 23-24, Law #6/2002, 12/16/2002	...	...	Articles 23-24, Law #6/2002, 12/16/2002	...	...	Law #15/2001, ban from 1/1/2002 through 1/7/2003
Aragón	Article 14(3), Law #9/1989, 10/5/1989	...	...	...	...	...	Article 27.2, Decree 112/2001, ban since 6/6/2001
Asturias	...	...	...	Articles 21&20, Law #10/2002, 11/19/2002	Article 21&30, Law #10/2002, 11/19/2002	...	Law #10/2002, ban since 12/20/2002
Baleares	Article 14, Law #11/2001, 6/15/2001	Article 14, Law #11/2001, 6/15/2001	Article 14, Law #11/2001, 6/15/2001	...	...	...	Decree #217/96, ban from 1/1/1997 through 12/1/2002
Canarias	Article 5, Decree #237/1998, 12/18/1998	...	...	...	...	...	Law #10/2003 & Decree #54/2003, ban since 4/20/2003 2/
Cantabria	...	...	...	Article 7, Law #1/2002, 2/26/2002	...	...	Several laws. ban since 9/1/2001
Castilla-La Mancha	...	...	...	...	...	...	...
Castilla-León	Article 8(4), Law #2/1996, 6/18/1996	...	...	...	...	...	Article 2, Law #16/2002 & Law #16/06, ban since 1/1/2003
Cataluña	Article 3(1), Law #1/1997, 3/24/1997	...	...	...	Article 3, Law #17/2000, 12/29/2000	Article 8, Decree #346/2001, 12/24/2001	Several laws, ban from 1/21-6/26/1996, 3/17/1997-1/1/2001, and 1/6-6/7/2001
Madrid	Article 17, Law #16/1999, 4/29/1999	...	...	Article 24, Law #16/1999, 4/29/1999	Article 24, Law #14/2001, 12/26/2001	...	...
Valencia	Article 17.2, Law #8/1986, 12/29/1986	...	...	...	...	...	...
Extremadura	Ley 3/2002 de 9 de mayo. Articulo 35	...	...	...	...	...	...
Galicia	Article 7, Law #10/1988, 7/20/1988	...	...	...	...	...	...
La Rioja	Article 7.2, Decree #20/1997, 3/26/1997	...	...	...	...	...	...
Murcia	Article 8, Law #10/1998, 12/21/1998	...	...	Article 9, Law #10/1998, 12/21/1998	...	...	...
Navarra	Decreto Foral 154/1993 de 10 de mayo. Artículo	...	...	Articles 31-32(2), "Foral" Law #17/2001, 7/12/2001	Articles 30-31(2), "Foral" Law #17/2001, 7/12/2001	...	Several laws, ban from 4/1/2003 through 4/1/2004
País Vasco	Law #7/2000, 11/10/2000	Law #7/2000, 11/10/2000	Law #7/2000, 11/10/2000	...	...	...	Several laws, ban from 1/1/2001 through 4/1/2001

Source: Tribunal de Defensa de la Competencia, 2003.

1/ For a discussion of the barriers, see Section II of the paper.
2/ These effectively impose a ban on large firms.

Table A2. Data Description and Sources

Series	Description	Source
$p_{j,t}$	Consumer price index (2001=100) in autonomous region *j* , in the t^{th} quarter. Data from 1996–2001 were spliced using the *coeficientes de enlace* published by National Institute of Statistics (INE). Subcomponents correspond to the eight PROCOME groups. From 2002 onward, the 12 COICOP groups were aggregated to conform with the PROCOME groupings. Specifically: (i) Food and beverages was constructed as the weighted average of *Alimentos y Bebidas no alcohólicas* and *Bebidas alcohólicas y Tabaco* ; (ii) Transportation and Communications was constructed as the weighted average of *Transportes* and *Comunicaciones* ; and (iii) Entertainment was constructed as the weighted average of *Ocio y Cultura, Ensenanza, and Hoteles* , and *Cafes y Restaurantes* . All weights stem from CPI (base year 2001). Data for 1996–2001 were spliced using INE's *coeficientes de enlace* .	National CPI definition (IPC), INE.
$w_{j,t}$	Hourly wage cost (2001=100) in autonomous region *j* , in the j^{th} quarter. Data from 1996–2001 were spliced using the *coeficientes de enlace* published by INE.	Quarterly survery of labor costs, and Industrial and Services Labor Cost survey (INE).
$Barrier_{j,t}$	Number of barriers to retail competition in autonomous region *j* , in the t^{th} quarter. These are detailed in Table 1.	Tribunal de la Defensa del Consumidor, 2003.

Table A3. Linear Model Estimates by Region

Dependent Variable	Right Hand Side Variable					
	Wages			Barriers		
	Coefficient	*t*-Stat		Coefficient	*t*-Stat	
CPI						
Andalucia	0.775	7.10	**	-0.004	-2.79	**
Aragon	-0.006	-0.20		0.005	2.75	**
Asturias	0.292	4.13	**	-0.004	-6.89	**
Baleares	-0.009	-0.16		0.006	4.36	**
Canarias	1.157	16.54	**	-0.015	-4.16	**
Cantabria	0.087	5.39	**	-0.004	-3.92	**
Castilla-La-Mancha	0.018	0.62		0.006	7.83	**
Castilla-Leon	0.108	2.05	**	0.007	4.09	**
Cataluna	0.655	8.26	**	-0.002	-0.78	
Madrid	-0.144	-3.14	**	-0.001	-2.22	**
Valencia	-0.015	-0.69		0.001	2.46	**
Extremadura	-0.672	-3.26	**	0.016	2.76	**
Galicia	-0.011	-0.82		0.001	3.21	**
La Rioja	0.207	1.10		-0.014	-5.90	**
Murcia	0.530	17.82	**	-0.001	-0.65	
Navarra	0.080	2.10	**	0.002	1.30	
País Vasco	-0.854	-4.45	**	0.005	10.62	**
MGE	0.129	5.57	**	0.000	0.50	
Food and beverage						
Andalucia	0.965	5.26	**	-0.006	-2.27	**
Aragon	0.043	0.51		-0.006	-1.15	
Asturias	1.512	7.56	**	-0.009	-6.11	**
Baleares	-0.067	-4.08	**	0.001	1.80	*
Canarias	0.308	3.21	**	0.000	0.05	
Cantabria	0.011	0.39		-0.007	-2.86	**
Castilla-La-Mancha	-0.007	-0.15		0.001	0.65	
Castilla-Leon	-0.421	-2.72	**	0.006	1.97	**
Cataluna	0.826	10.45	**	-0.006	-2.24	**
Madrid	0.025	0.72		-0.001	-0.81	
Valencia	0.014	0.34		0.002	2.63	**
Extremadura	0.005	0.08		0.018	4.11	**
Galicia	0.020	0.53		0.008	6.56	**
La Rioja	0.009	0.18		-0.013	-4.19	**
Murcia	0.068	1.56		0.004	2.28	**
Navarra	0.141	1.68	*	0.002	0.52	
País Vasco	-0.086	-0.59		-0.001	-3.79	**
MGE	0.198	8.29	**	0.000	-0.55	
Clothing and footwear						
Andalucia	0.843	5.90	**	-0.011	-5.68	**
Aragon	0.076	0.63		0.017	3.31	**
Asturias	-0.215	-1.74	*	0.002	0.67	
Baleares	-0.008	-0.14		0.008	2.20	**
Canarias	0.490	2.05	**	-0.019	-1.11	
Cantabria	0.067	1.26		0.001	0.24	
Castilla-La-Mancha	-0.441	-1.95	**	0.010	5.83	**
Castilla-Leon	0.851	5.94	**	0.009	2.96	**
Cataluna	2.130	9.96	**	-0.005	-0.71	
Madrid	0.046	0.59		-0.017	-6.27	**
Valencia	-0.029	-0.32		-0.038	-19.43	**
Extremadura	-0.879	-2.86	**	0.042	4.78	**
Galicia	-0.041	-0.79		-0.004	-2.06	**
La Rioja	0.237	2.42	**	0.028	4.80	**
Murcia	0.629	6.31	**	0.004	1.33	
Navarra	2.051	9.62	**	0.000	-0.04	
País Vasco	0.025	0.91		0.004	3.32	**
MGE	0.343	9.14	**	0.002	1.29	

Table A3. Linear Model Estimates by Region (Continued)

	Right Hand Side Variable					
	Wages			Barriers		
	Coefficient	*t*-Stat		Coefficient	*t*-Stat	
Housing						
Andalucia	1.011	7.45	**	-0.003	-1.52	
Aragon	0.004	0.09		-0.009	-2.86	**
Asturias	-0.065	-1.29		-0.002	-1.83	*
Baleares	0.089	0.52		0.014	3.39	**
Canarias	1.838	17.63	**	-0.032	-6.02	**
Cantabria	0.180	4.42	**	0.002	0.76	
Castilla-La-Mancha	0.024	0.29		-0.001	-0.47	
Castilla-Leon	-0.055	-0.28		-0.023	-3.74	**
Cataluna	0.597	10.42	**	0.008	4.35	**
Madrid	-0.002	-0.05		-0.007	-3.66	**
Valencia	-0.092	-0.62		0.025	7.57	**
Extremadura	-0.806	-2.84	**	0.017	2.06	**
Galicia	0.003	0.03		-0.019	-9.67	**
La Rioja	-0.025	-0.63		-0.020	-8.21	**
Murcia	0.478	7.30	**	-0.007	-3.64	**
Navarra	-0.710	-3.98	**	-0.013	-3.03	**
País Vasco	-2.034	-3.73	**	-0.003	-1.93	*
MGE	0.026	0.58		-0.004	-4.82	**
Household items						
Andalucia	0.950	7.70	**	-0.019	-11.15	**
Aragon	-0.032	-0.52		0.003	0.84	
Asturias	1.383	7.24	**	-0.003	-2.40	**
Baleares	-0.190	-2.31	**	0.006	2.86	**
Canarias	0.241	1.37		-0.006	-0.45	
Cantabria	0.881	11.10	**	-0.009	-1.63	
Castilla-La-Mancha	-0.069	-1.23		0.018	11.20	**
Castilla-Leon	0.008	0.29		0.000	0.24	
Cataluna	1.395	10.07	**	-0.008	-1.70	*
Madrid	0.010	0.28		-0.003	-2.49	**
Valencia	0.009	0.16		-0.007	-5.85	**
Extremadura	-0.954	-3.88	**	0.026	3.67	**
Galicia	-0.275	-3.39	**	-0.012	-9.91	**
La Rioja	0.200	0.30		-0.056	-6.64	**
Murcia	0.516	9.64	**	0.009	5.61	**
Navarra	0.407	5.84	**	-0.002	-0.86	
País Vasco	-2.681	-6.17	**	0.018	17.17	**
MGE	0.106	1.99	**	-0.003	-2.39	**
Medicine and health						
Andalucia	1.669	7.14	**	-0.015	-4.86	**
Aragon	-0.264	-0.90		-0.116	-6.16	**
Asturias	-0.185	-1.00		0.011	7.67	**
Baleares	-0.250	-1.66	*	-0.012	-3.35	**
Canarias	-0.013	-0.26		-0.009	-2.42	**
Cantabria	1.179	14.43	**	-0.014	-2.94	**
Castilla-La-Mancha	-0.077	-0.75		0.030	10.61	**
Castilla-Leon	-0.025	-0.37		0.003	1.57	
Cataluna	-0.164	-1.19		0.011	1.72	*
Madrid	-0.021	-0.16		-0.017	-3.78	**
Valencia	-0.100	-1.00		-0.007	-3.41	**
Extremadura	0.001	0.02		0.017	3.59	**
Galicia	0.003	0.05		-0.024	-13.33	**
La Rioja	0.148	0.46		-0.037	-8.85	**
Murcia	0.407	3.68	**	0.009	2.23	**
Navarra	0.333	1.13		0.068	9.26	**
País Vasco	1.807	2.88	**	-0.011	-7.40	**
MGE	0.262	4.76	**	-0.007	-4.63	**

Table A3. Linear Model Estimates by Region (Concluded)

	Right Hand Side Variable					
	Wages			Barriers		
	Coefficient	*t*-Stat		Coefficient	*t*-Stat	
Transporation and communication						
Andalucia	0.510	9.15	**	-0.006	-7.72	**
Aragon	-0.125	-0.87		-0.004	-0.60	
Asturias	-0.216	-3.21	**	0.000	-0.77	
Baleares	-0.022	-0.95		0.008	5.73	**
Canarias	-0.266	-2.29	**	0.030	5.14	**
Cantabria	0.041	2.18	**	0.009	5.26	**
Castilla-La-Mancha	0.018	0.58		0.004	4.19	**
Castilla-Leon	0.048	2.36	**	0.001	1.58	
Cataluna	-0.124	-2.38	**	0.000	0.16	
Madrid	-0.011	-0.15		0.002	0.69	
Valencia	0.037	1.09		-0.002	-2.34	**
Extremadura	-0.018	-0.45		0.012	4.36	**
Galicia	0.005	0.21		-0.003	-3.85	**
La Rioja	0.006	0.30		0.011	9.28	**
Murcia	0.034	1.83	**	-0.001	-2.14	**
Navarra	-0.452	-7.25	**	0.005	3.38	**
País Vasco	-0.011	-0.65		0.000	0.06	
MGE	-0.032	-2.22	**	0.004	6.47	**
Entertainment						
Andalucia	0.082	0.99		0.010	3.98	**
Aragon	0.201	3.05	**	-0.004	-0.95	
Asturias	-1.317	-3.02	**	0.008	2.48	**
Baleares	0.452	1.48		0.002	0.08	
Canarias	0.176	1.38		-0.010	-1.12	
Cantabria	0.115	2.15	**	0.002	0.42	
Castilla-La-Mancha	-0.022	-0.16		0.007	1.73	*
Castilla-Leon	-0.022	-0.20		-0.008	-2.35	**
Cataluna	-0.125	-0.77		0.009	1.17	
Madrid	-0.027	-0.16		-0.018	-3.34	**
Valencia	0.069	0.68		0.013	5.92	**
Extremadura	0.628	1.74	*	0.028	2.70	**
Galicia	-0.035	-0.63		-0.004	-2.24	**
La Rioja	0.017	0.24		0.003	0.78	
Murcia	1.340	8.02	**	-0.003	-0.52	
Navarra	0.296	2.72	**	-0.003	-0.79	
País Vasco	0.019	0.37		0.001	0.64	
MGE	0.109	2.41	**	0.002	1.13	
Other						
Andalucia	1.209	7.50	**	-0.016	-7.21	**
Aragon	-0.064	-0.34		0.047	6.91	**
Asturias	1.614	8.68	**	-0.022	-15.64	**
Baleares	0.276	1.83	*	0.014	3.92	**
Canarias	2.541	4.43	**	0.003	0.14	
Cantabria	-0.330	-12.71	**	-0.022	-12.59	**
Castilla-La-Mancha	0.054	0.72		0.015	7.36	**
Castilla-Leon	1.342	7.52	**	0.020	5.40	**
Cataluna	0.526	2.11	**	-0.006	-0.52	
Madrid	-0.564	-3.85	**	0.006	3.44	**
Valencia	-0.271	-1.88	*	-0.002	-0.77	
Extremadura	-1.348	-4.37	**	0.009	1.07	
Galicia	0.093	1.47		0.021	9.90	**
La Rioja	-0.015	-0.03		-0.045	-6.25	**
Murcia	0.374	6.23	**	0.001	0.72	
Navarra	0.201	1.45		0.016	4.78	**
País Vasco	-3.084	-4.21	**	0.022	12.40	**
MGE	0.150	2.04	**	0.004	2.21	**

Note: * (**) denotes rejection of the null hypothesis at the 10 (5) percent significance level. Estimates are obtained by applying DOLS to the individual regional data; leads and lags are determined by testing down from 3.

Table A4. Threshold Models by Region

Dependent Variable	Model 1						Model 2				
	Wages		I (Barriers ≥ 1)		I (Barriers ≥ 2)		Wages		I (Barriers ≥ 1)		Price effect
	Coefficient	t -Stat	Coefficient	t -Stat	Coefficient	t -Stat	Coefficient	t -Stat	Coefficient	t -Stat	(In percent)
CPI											
Andalucia	0.730	7.48 **	-0.010	-3.11 **	0.007	1.72 *	0.707	6.97 **	-0.008	-3.83 **	-0.8
Aragon	-0.013	-0.52	0.009	3.59 **	0.003	1.52	-0.003	-0.12	0.006	3.35 **	0.6
Asturias	0.139	1.94 *	-0.029	-5.07 **	0.029	3.73 **	0.283	5.07 **	-0.011	-10.41 **	-1.0
Baleares	-0.012	-0.75	0.001	0.12	0.020	5.73 **	-0.011	-0.46	-0.007	-1.51	-0.7
Canarias	0.809	7.14 **	-0.013	-3.72 **	-0.007	-1.63	0.850	9.35 **	-0.011	-3.45 **	-1.1
Cantabria	0.025	1.17	0.010	1.23	-0.022	-1.87 *	0.053	2.61 **	-0.005	-3.38 **	-0.5
Castilla-La-Mancha	0.013	0.66	0.035	7.78 **	-0.013	-3.43 **	0.013	0.57	0.021	11.36 **	2.1
Castilla-Leon	0.058	1.02	0.010	3.69 **	-0.004	-1.22	0.083	1.54	0.011	3.99 **	1.1
Cataluna	0.346	2.14 **	0.014	0.65	-0.025	-1.93 *	0.549	5.53 **	-0.011	-1.64	-1.1
Madrid	-0.157	-3.12 **	-0.004	-1.26	0.002	0.62	-0.171	-3.60 **	-0.002	-1.58	-0.2
Valencia	-0.011	-0.60	0.015	4.99 **	-0.009	-3.60 **	-0.023	-1.13	0.005	3.81 **	0.5
Extremadura	-0.092	-0.64	0.026	8.66 **	0.063	10.39 **	-1.029	-6.96 **	-0.005	-1.11	-0.4
Galicia	-0.013	-0.97	0.001	0.13	0.003	0.85	-0.011	-0.83	0.004	2.66 **	0.4
La Rioja	0.020	0.78	0.007	1.99 **	-0.037	-11.25 **	0.280	1.75 *	-0.055	-7.58 **	-5.4
Murcia	0.448	8.54 **	0.017	1.39	-0.014	-1.46	0.549	19.56 **	0.001	0.52	0.1
Navarra	-0.013	-0.55	-0.021	-8.04 **	-0.002	-0.93	-0.016	-0.66	-0.020	-8.77 **	-2.0
País Vasco	-1.010	-3.82 **	-0.005	-0.58	0.022	2.01 **	-0.941	-4.29 **	0.012	6.86 **	1.2
MGE	0.075	3.20 **	0.004	2.03 **	0.001	0.54	0.068	3.15 **	-0.004	-5.47 **	-0.4
Food and beverage											
Andalucia	1.054	4.46 **	-0.003	-0.26	0.065	1.29	0.156	1.48	0.014	1.27	1.4
Aragon	0.019	0.19	-0.012	-0.88	-0.036	-0.55	0.046	0.56	-0.017	-1.41	-1.6
Asturias	0.145	1.47	-0.022	-2.82 **	0.202	2.50 **	0.815	2.45 **	0.022	1.16	2.2
Baleares	-0.025	-1.73 *	-0.002	-0.73	0.004	1.12	-0.072	-4.13 **	0.001	0.28	0.1
Canarias	0.952	4.98 **	-0.091	-3.33 **	0.176	1.92 *	0.106	1.33	-0.019	-1.16	-1.8
Cantabria	0.007	0.20	-0.005	-0.53	0.085	1.76 *	0.022	0.67	-0.001	-0.09	-0.1
Castilla-La-Mancha	-0.025	-0.54	0.003	0.45	0.041	1.20	-0.009	-0.21	0.005	0.79	0.5
Castilla-Leon	-0.706	-5.31 **	0.109	4.79 **	-0.120	-2.51 **	-0.189	-2.05 **	0.015	1.54	1.5
Cataluna	0.907	11.87 **	-0.004	-1.92 *	0.157	4.37 **	0.721	8.50 **	-0.006	-2.09 **	-0.6
Madrid	0.024	0.72	-0.004	-1.71 *	0.010	0.30	0.023	0.70	-0.004	-1.74 *	-0.4
Valencia	-0.286	-3.30 **	0.037	3.84 **	0.002	0.08	0.047	1.18	0.006	1.30	0.6
Extremadura	-0.716	-3.83 **	0.051	2.90 **	-0.157	-2.46 **	-0.679	-3.65 **	0.034	2.10 **	3.4
Galicia	1.040	3.48 **	0.142	4.68 **	0.321	3.46 **	-0.008	-0.15	0.029	2.93 **	2.9
La Rioja	-0.006	-0.11	-0.039	-2.42 **	-0.204	-2.77 **	0.002	0.04	-0.054	-3.33 **	-5.3
Murcia	0.088	1.87 *	0.003	1.05	-0.013	-0.25	0.264	4.48 **	0.006	2.07 **	0.6
Navarra	0.095	1.17	0.005	1.12	-0.144	-2.25 **	0.078	0.91	0.008	1.84 *	0.8
País Vasco	-0.464	-2.93 **	-0.005	-3.44 **	0.019	4.15 **	-0.085	-0.49	-0.005	-3.50 **	-0.5
MGE	0.124	3.79 **	0.010	2.75 **	0.024	1.73 *	0.073	2.53 **	0.002	0.80	0.2
Clothng and footwear											
Andalucia	0.095	1.02	0.002	0.19	0.138	2.26 **	0.097	0.99	0.009	0.92	0.9
Aragon	0.092	1.01	0.011	0.79	0.106	1.75 *	0.606	4.77 **	0.017	1.41	1.7
Asturias	-0.194	-1.53	0.002	0.23	-0.066	-0.63	-0.962	-2.64 **	-0.032	-1.57	-3.2
Baleares	0.334	1.37	-0.023	-0.67	0.036	1.18	-0.028	-0.52	0.023	2.96 **	2.3
Canarias	1.452	7.81 **	0.376	14.21 **	-0.469	-5.24 **	1.591	5.93 **	0.291	7.09 **	33.7
Cantabria	0.670	3.13 **	-0.193	-2.91 **	-0.087	-1.39	0.692	3.04 **	-0.226	-3.26 **	-20.2
Castilla-La-Mancha	-0.002	-0.04	0.014	1.63	-0.077	-1.79 *	-0.001	0.00	0.026	1.81 *	2.7
Castilla-Leon	0.217	1.47	0.051	3.05 **	0.073	0.92	0.200	1.37	0.057	3.65 **	5.8
Cataluna	2.584	17.80 **	-0.008	-1.32	0.557	8.42 **	2.065	9.35 **	-0.003	-0.39	-0.3
Madrid	-2.000	-7.18 **	0.011	1.79 *	-0.149	-1.74 *	-1.540	-6.64 **	0.005	0.77	0.5
Valencia	-1.837	-5.43 **	-0.153	-4.09 **	-0.270	-2.54 **	-1.652	-6.84 **	-0.190	-7.16 **	-17.3
Extremadura	-1.065	-5.75 **	0.193	9.36 **	-0.105	-2.62 **	-1.300	-6.07 **	0.148	6.74 **	15.9
Galicia	-0.009	-0.16	-0.017	-1.62	0.072	1.49	-0.777	-3.96 **	-0.123	-4.00 **	-11.6
La Rioja	2.348	5.27 **	0.072	1.89 *	-0.137	-0.95	2.455	5.76 **	0.053	1.65	5.5
Murcia	0.658	6.31 **	0.005	0.90	-0.139	-1.61	0.642	6.27 **	0.003	0.62	0.3
Navarra	1.922	6.56 **	0.007	0.72	-0.079	-0.82	1.874	6.58 **	0.006	0.68	0.6
País Vasco	0.299	0.93	0.012	4.21 **	0.029	2.92 **	0.015	0.56	0.009	3.22 **	0.9
MGE	0.327	6.05 **	0.021	3.52 **	-0.033	-1.76 *	0.234	4.34 **	0.004	0.69	0.4

Table A4. Threshold Models by Region (Continued)

Dependent Variable	Model 1						Model 2				
	Wages		*I* (Barriers ? 1)		*I* (Barriers ? 2)		Wages		*I* (Barriers ? 1)		Price effect
	Coefficient	*t* -Stat	Coefficient	*t* -Stat	Coefficient	*t* -Stat	Coefficient	*t* -Stat	Coefficient	*t* -Stat	(In percent)
Housing											
Andalucia	0.990	5.01 **	-0.006	-0.55	0.055	1.31	0.949	5.66 **	-0.001	-0.13	-0.1
Aragon	0.011	0.17	-0.015	-1.75 *	0.058	1.46	-0.034	-0.66	-0.008	-1.12	-0.8
Asturias	-1.349	-8.48 **	-0.038	-8.42 **	0.387	9.24 **	-0.072	-1.39	-0.004	-1.07	-0.4
Baleares	-0.586	-1.76 *	0.076	1.61	-0.053	-1.28	0.152	0.79	0.040	2.83 **	4.0
Canarias	1.274	7.74 **	0.078	3.77 **	-0.087	-1.04	1.198	7.78 **	0.060	3.49 **	6.2
Cantabria	-0.031	-1.31	0.018	2.54 **	-0.012	-0.36	-0.033	-1.48	0.018	2.56 **	1.8
Castilla-La-Mancha	0.103	1.26	-0.021	-1.64	-0.096	-1.57	0.067	0.83	-0.026	-2.09 **	-2.6
Castilla-Leon	-0.099	-0.57	-0.022	-1.13	-0.413	-4.40 **	-0.002	-0.01	-0.054	-2.38 **	-5.3
Cataluna	0.749	10.46 **	0.007	3.29 **	0.049	1.46	0.692	11.36 **	0.007	3.16 **	0.7
Madrid	-0.031	-0.51	-0.004	-1.03	0.033	0.52	-0.036	-0.60	-0.004	-1.05	-0.4
Valencia	0.946	4.25 **	0.168	7.04 **	0.071	0.74	-0.038	-0.16	0.225	8.67 **	25.2
Extremadura	-1.016	-7.08 **	0.073	5.34 **	-0.088	-1.80 *	-0.961	-6.98 **	0.068	5.65 **	7.0
Galicia	-0.608	-2.38 **	-0.155	-6.00 **	-0.090	-1.14	-0.375	-3.17 **	-0.138	-7.42 **	-12.9
La Rioja	-1.089	-5.89 **	-0.060	-3.75 **	-0.058	-0.96	-1.185	-6.22 **	-0.068	-4.69 **	-6.6
Murcia	0.176	3.33 **	-0.008	-2.27 **	0.185	3.12 **	0.174	2.94 **	-0.004	-1.08	-0.4
Navarra	-0.499	-1.96 **	-0.021	-2.43 **	0.036	0.42	-0.424	-1.89 *	-0.025	-3.54 **	-2.4
País Vasco	-0.568	-1.25	0.000	0.07	-0.075	-5.80 **	0.004	0.08	-0.008	-1.65 *	-0.8
MGE	-0.096	-1.95 *	0.004	0.97	-0.006	-0.39	0.004	0.13	0.005	1.42	0.5
Household items											
Andalucia	0.059	0.58	0.012	1.13	0.025	0.38	0.059	0.60	0.013	1.34	1.3
Aragon	0.012	0.18	0.002	0.15	0.057	1.26	-0.032	-0.54	0.008	0.98	0.8
Asturias	1.684	5.40 **	0.003	0.42	-0.130	-1.64	1.174	5.78 **	-0.003	-0.38	-0.2
Baleares	0.181	1.40	-0.026	-1.45	0.046	2.82 **	-0.035	-1.38	0.001	0.12	0.1
Canarias	0.831	8.93 **	0.275	20.75 **	-0.064	-1.43	0.926	8.11 **	0.255	14.60 **	29.0
Cantabria	0.870	8.71 **	0.065	2.34 **	-0.356	-4.28 **	0.787	6.41 **	0.032	0.96	3.3
Castilla-La-Mancha	-0.024	-0.05	0.147	7.99 **	0.038	0.23	-0.458	-2.66 **	0.177	9.23 **	19.4
Castilla-Leon	0.023	1.01	-0.008	-3.12 **	0.032	2.69 **	0.015	0.62	-0.005	-2.11 **	-0.5
Cataluna	1.596	18.68 **	-0.007	-1.96 **	0.328	8.41 **	1.273	8.93 **	-0.008	-1.69 *	-0.8
Madrid	-0.797	-5.07 **	0.019	4.64 **	-0.106	-1.74 *	-0.005	-0.14	-0.002	-0.90	-0.2
Valencia	-0.102	-1.58	-0.021	-2.54 **	-0.054	-1.41	-0.081	-1.26	-0.026	-3.34 **	-2.5
Extremadura	-1.473	-10.30 **	0.071	5.22 **	-0.076	-1.56	-1.423	-10.66 **	0.065	5.62 **	6.7
Galicia	-0.736	-3.23 **	-0.136	-5.87 **	-0.058	-0.82	-0.628	-5.81 **	-0.137	-8.01 **	-12.8
La	-1.925	-4.55 **	-0.328	-6.30 **	0.352	2.59 **	-2.468	-4.45 **	-0.231	-3.77 **	-20.6
Murcia	0.627	13.42 **	0.014	6.02 **	-0.251	-6.46 **	0.613	8.41 **	0.009	2.57 **	0.9
Navarra	0.397	4.88 **	-0.002	-0.64	-0.083	-2.15 **	0.369	4.40 **	0.000	0.03	0.0
Pais	-0.039	-0.60	0.030	4.08 **	-0.014	-1.08	-3.322	-4.49 **	0.043	6.95 **	4.4
MGE	0.070	1.45	0.006	1.46	-0.018	-1.08	-0.190	-3.18 **	0.011	2.40 **	1.1
Medicine and health											
Andalucia	1.446	3.87 **	0.016	0.77	0.049	0.61	0.170	1.30	0.023	1.70 *	2.3
Aragon	-0.829	-0.50	-0.377	-1.84 *	-0.577	-0.83	-0.622	-1.35	-0.440	-8.50 **	-35.6
Asturias	0.079	0.70	0.019	2.14 **	-0.119	-1.28	0.054	0.48	0.015	1.76 *	1.5
Baleares	-1.397	-2.96 **	0.241	3.37 **	-0.269	-3.53 **	-0.506	-2.96 **	-0.048	-5.86 **	-4.7
Canarias	-0.031	-0.59	0.019	1.76 *	0.001	0.01	-0.031	-0.60	0.019	1.92 *	2.0
Cantabria	1.229	10.39 **	0.064	1.97 **	-0.198	-2.01 **	0.705	2.23 **	0.126	1.28	13.4
Castilla-La-Mancha	-2.293	-1.12	0.044	0.67	1.860	2.94 **	1.797	3.88 **	0.053	1.18	5.4
Castilla-Leon	-0.016	-0.23	0.002	0.19	0.061	1.62	-0.031	-0.43	0.006	0.82	0.6
Cataluna	-0.379	-1.60	0.035	3.64 **	-0.027	-0.25	-0.175	-0.73	0.047	4.69 **	4.8
Madrid	-0.085	-0.55	-0.013	-1.36	0.152	0.94	-0.107	-0.70	-0.013	-1.38	-1.3
Valencia	-0.083	-0.52	-0.019	-1.15	-0.272	-4.01 **	-0.214	-2.05 **	-0.017	-1.35	-1.7
Extremadura	-0.015	-0.24	0.054	4.21 **	-0.022	-0.37	-0.016	-0.25	0.052	4.40 **	5.3
Galicia	-0.682	-1.59	-0.234	-5.37 **	-0.203	-1.52	-0.222	-1.06	-0.203	-6.14 **	-18.3
La Rioja	-1.165	-3.10 **	-0.192	-4.16 **	0.091	0.75	-1.457	-4.05 **	-0.161	-4.05 **	-14.9
Murcia	0.323	3.77 **	0.000	-0.06	-0.378	-3.94 **	0.326	3.19 **	-0.009	-1.36	-0.8
Navarra	-0.467	-1.12	0.106	7.61 **	0.423	3.05 **	-0.687	-1.76 *	0.113	9.17 **	12.0
País Vasco	0.042	0.81	-0.011	-1.93 *	0.026	2.44 **	0.019	0.35	-0.006	-1.04	-0.6
MGE	-0.254	-1.53	-0.015	-1.03	0.035	0.59	-0.059	-0.98	-0.026	-3.28 **	-2.6

Table A4. Threshold Models by Region (Concluded)

Dependent Variable	Model 1						Model 2				
	Wages		I (Barriers ≥ 1)		I (Barriers ≥ 2)		Wages		I (Barriers ≥ 1)		Price effect
	Coefficient	*t*-Stat	Coefficient	*t*-Stat	Coefficient	*t*-Stat	Coefficient	*t*-Stat	Coefficient	*t*-Stat	(In percent)
Transportation and communication											
Andalucia	0.032	0.85	0.006	1.47	0.010	0.42	0.032	0.86	0.006	1.72 *	0.6
Aragon	-1.686	-3.99 **	0.214	4.09 **	-0.725	-4.08 **	-0.106	-1.40	-0.002	-0.15	-0.2
Asturias	-0.051	-1.82 *	-0.001	-0.24	-0.005	-0.22	-0.052	-1.91 *	-0.001	-0.37	-0.1
Baleares	-0.797	-9.08 **	0.074	6.02 **	-0.056	-5.12 **	-0.284	-3.84 **	0.020	3.73 **	2.0
Canarias	0.011	0.15	-0.044	-2.88 **	-0.116	-1.58	0.013	0.18	-0.053	-3.59 **	-5.1
Cantabria	0.150	1.27	-0.066	-1.80 *	0.089	2.57 **	0.032	1.18	-0.003	-0.35	-0.3
Castilla-La-Mancha	-0.007	-0.22	0.016	3.47 **	0.059	2.63 **	-0.077	-1.24	0.042	5.98 **	4.3
Castilla-Leon	0.044	2.32 **	0.004	1.99 **	0.014	1.35	0.041	2.14 **	0.005	2.63 **	0.5
Cataluna	-0.088	-1.78 *	0.005	1.92 *	0.076	1.76 *	-0.112	-2.28 **	0.005	1.82 *	0.5
Madrid	1.643	4.25 **	-0.038	-3.84 **	0.532	3.56 **	-0.001	-0.01	-0.001	-0.13	-0.1
Valencia	0.018	0.61	-0.010	-2.54 **	-0.025	-1.40	0.028	0.94	-0.012	-3.34 **	-1.2
Extremadura	-0.388	-6.61 **	0.037	6.59 **	-0.123	-6.17 **	-0.366	-4.08 **	0.022	2.89 **	2.3
Galicia	-0.453	-4.17 **	-0.090	-7.54 **	-0.019	-0.61	0.012	0.41	-0.013	-2.46 **	-1.3
La Rioja	0.668	4.89 **	0.056	3.32 **	-0.074	-1.69 *	0.708	5.49 **	0.035	2.48 **	3.6
Murcia	0.028	1.84 *	-0.003	-2.52 **	-0.013	-0.80	0.011	0.57	-0.003	-3.22 **	-0.3
Navarra	-0.542	-5.93 **	0.008	2.56 **	0.011	0.36	-0.509	-5.79 **	0.008	2.84 **	0.8
País Vasco	-0.005	-0.33	-0.001	-0.72	0.006	1.92 *	-0.011	-0.66	0.000	-0.02	0.0
MGE	-0.084	-2.24 **	0.010	2.33 **	-0.021	-1.36	-0.038	-2.49 **	0.003	1.95 *	0.3
Entertainment											
Andalucia	0.124	1.19	0.012	1.04	0.001	0.02	0.124	1.21	0.012	1.12	1.2
Aragon	0.124	1.66 *	0.006	0.51	-0.077	-1.56	0.183	2.82 **	-0.004	-0.38	-0.3
Asturias	0.019	0.12	0.015	1.20	-0.225	-1.73 *	-0.029	-0.18	0.006	0.54	0.6
Baleares	-6.683	-4.59 **	1.517	7.42 **	-1.394	-7.67 **	0.423	1.40	0.047	1.05	4.8
Canarias	1.126	7.42 **	0.161	8.47 **	-0.239	-3.10 **	1.010	5.56 **	0.118	5.84 **	12.5
Cantabria	0.083	1.70 *	0.059	3.89 **	-0.174	-2.41 **	0.052	1.03	0.050	3.17 **	5.1
Castilla-La-Mancha	-0.120	-0.93	0.057	2.83 **	0.102	1.06	-1.491	-5.37 **	0.209	6.74 **	23.3
Castilla-Leon	-0.916	-4.01 **	0.177	4.74 **	-0.349	-4.14 **	-0.030	-0.25	0.001	0.04	0.1
Cataluna	-0.468	-1.49	0.021	2.23 **	-0.020	-0.13	-0.086	-0.24	0.042	2.89 **	4.3
Madrid	-0.109	-0.60	-0.019	-1.66 *	0.032	0.17	-0.113	-0.64	-0.019	-1.68 *	-1.8
Valencia	0.199	1.72 *	0.056	3.79 **	-0.062	-0.90	0.951	5.68 **	0.045	3.09 **	4.6
Extremadura	-0.050	-0.53	0.007	0.36	0.026	0.29	-0.050	-0.53	0.009	0.50	0.9
Galicia	0.005	0.08	0.001	0.10	-0.022	-0.40	0.012	0.20	0.000	0.01	0.0
La Rioja	0.041	0.61	-0.019	-0.92	0.252	2.60 **	0.032	0.43	0.000	0.00	0.0
Murcia	1.279	8.48 **	-0.003	-0.40	-0.320	-2.55 **	1.295	8.05 **	-0.014	-1.88 *	-1.4
Navarra	0.280	2.49 **	-0.004	-0.62	-0.169	-1.90 *	1.397	4.88 **	-0.035	-3.92 **	-3.4
País Vasco	-1.848	-3.28 **	-0.024	-5.07 **	0.189	6.40 **	0.016	0.30	0.003	0.52	0.3
MGE	-0.407	-4.15 **	0.119	9.41 **	-0.144	-5.61 **	0.217	4.89 **	0.028	6.22 **	2.8
Other											
Andalucia	1.363	3.38 **	0.005	0.19	0.182	2.50 **	0.210	2.13 **	0.009	0.89	0.9
Aragon	0.089	0.88	0.036	2.44 **	0.004	0.06	0.116	0.83	0.095	6.00 **	9.9
Asturias	2.030	3.63 **	-0.099	-4.51 **	0.525	4.18 **	0.010	0.05	-0.029	-2.15 **	-2.9
Baleares	1.063	2.00 **	-0.188	-2.33 **	0.224	2.61 **	0.270	1.70 *	0.037	3.19 **	3.7
Canarias	2.447	7.64 **	0.256	6.38 **	-0.106	-0.65	2.573	8.67 **	0.244	7.41 **	27.7
Cantabria	-0.108	-2.16 **	-0.013	-0.83	-0.045	-0.62	-0.116	-2.43 **	-0.015	-1.03	-1.5
Castilla-La-Mancha	0.713	1.40	0.139	7.03 **	-0.228	-1.30	-0.301	-1.67 *	0.169	8.37 **	18.4
Castilla-Leon	1.520	8.07 **	0.046	2.56 **	0.122	1.72 *	1.455	7.89 **	0.068	4.50 **	7.0
Cataluna	2.277	6.51 **	-0.022	-2.15 **	0.431	2.62 **	1.735	4.10 **	-0.033	-2.27 **	-3.2
Madrid	0.057	1.51	0.000	-0.05	0.044	1.12	0.051	1.36	0.000	-0.07	0.0
Valencia	-1.584	-13.52 **	0.172	13.74 **	-0.372	-7.39 **	-0.350	-2.61 **	0.013	0.82	1.3
Extremadura	-1.502	-4.84 **	0.038	1.19	0.208	3.41 **	-1.307	-5.99 **	0.067	3.57 **	7.0
Galicia	1.471	2.27 **	0.212	3.22 **	0.425	2.11 **	0.404	1.21	0.136	2.58 **	14.5
La Rioja	-1.226	-3.75 **	-0.353	-8.78 **	0.069	0.66	-1.613	-4.55 **	-0.306	-7.06 **	-26.3
Murcia	0.380	5.85 **	0.001	0.21	0.011	0.20	0.378	6.46 **	0.002	0.60	0.2
Navarra	-0.159	-0.93	0.031	5.49 **	0.127	2.24 **	-0.251	-1.66 *	0.034	7.22 **	3.5
País Vasco	-0.066	-0.85	0.033	3.76 **	-0.033	-2.05 **	-0.037	-0.46	0.026	3.10 **	2.7
MGE	0.516	6.25 **	0.017	2.20 **	0.093	3.61 **	0.190	3.70 **	0.030	5.73 **	3.1

Note: *(**) denotes rejection of the hypothesis at the 10(5) percent level. For details of the estimation procedure, see Table 2.

Table A5. Unconditional Price and Wage Convergence

	H_0: $x_{j,t}$ - $x_{k,t}$ ~ I(1)	
	x =CPI	x =wages
Test statistics by region		
Andalucía	-2.66 **	-1.05
Aragón	-1.90	-0.70
Asturias	-1.31	-1.41
Baleares	-1.51	0.75
Canarias	0.96	-0.99
Cantabria	-0.54	-2.34 **
Castilla-La Mancha	-1.78	-0.87
Castilla-León	-0.79	-1.52
Cataluña	-0.28	-0.69
Madrid	-2.13 **	-1.60
Valencia	-2.02 **	-0.25
Extremadura	-0.80	-1.91
Galicia	-1.62	-1.16
La Rioja	-1.11	-1.07
Murcia	-0.05	-0.16
Navarra	-2.75 **	-0.66
País Vasco	-1.62	-3.15 **
Panel test statistics		
Levin-Lin-Chu	2.13	2.07
Im-Pesaran-Shin	1.23	2.14

Note: *(**) denotes rejection of the null hypothesis of nonconvergence at the 5 (1) percent significance level.

Table A6. Conditional Price Convergence

	H_0: $(CPI_{j,t} - CPI_{k,t}) - \beta_j \times (x_{j,t} - x_{k,t}) \sim I(1)$		
x:	wages	barriers	wages, & barriers
Test statistics by region:			
Andalucía	-3.09 **	-2.64 **	-3.14 **
Aragón	-1.99 *	-1.98 *	-2.02 **
Asturias	-1.31	-2.18 **	-2.16 **
Baleares	-1.46	-1.20	-1.18
Canarias	1.66	0.30	1.23
Cantabria	-0.06	-1.71 *	-2.42 **
Castilla-La Mancha	-1.86 *	-1.58	-1.66 *
Castilla-León	-1.38	-0.87	-1.49
Cataluña	1.04	-0.08	1.04
Madrid	-2.18 **	-4.34 **	-4.43 **
Valencia	-2.00 **	-1.67 *	-1.65 *
Extremadura	-0.29	-1.97 **	-1.46
Galicia	-1.61	-1.35	-1.42
La Rioja	-1.11	-2.85 **	-3.11
Murcia	-0.53	-0.30	-0.44
Navarra	-3.62 **	-3.08 **	-3.92 **
País Vasco	-1.59	-2.16 **	-2.03 **
Panel test statistics:			
Panel PP	-1.50	-0.77	-1.62
Panel ADF	3.60	1.48	3.28
Group PP	-1.70 *	-1.82 *	-2.15 **
Group ADF	3.92	1.45	3.53
MGE	-1.26	-1.74 *	-1.78 *

Note: *(**) denotes rejection of the null hypothesis of nonconvergence at the 5 (1) percent significance level.

Table A7. Unconditional Price Convergence by Price Subgroups

	CPI		Food and beverages 1/		Clothing and footwear		Housing		Household items		Medicine and health		Transportation and communication /2		Entertainment /3		Other goods and services	
	1989–2005	1978–1988	1989–2005	1978–1988	1989–2005	1978–1988	1989–2005	1978–1988	1989–2005	1978–1988	1989–2005	1978–1988	1989–2005	1978–1988	1989–2005	1978–1988	1989–2005	1978–1988
Levin-Lin-Chu	3.00	0.30	1.69	-0.73	2.60	0.61	0.79	-0.25	3.84	-3.16 **	2.01	-0.43	-0.90	0.76	-2.06 **	0.13	2.33	0.20
Im-Pesaran-Shin	3.22	-1.44	0.69	-3.38 **	1.94	-0.19	-0.64	-1.68 *	3.60	-6.94 **	1.02	-2.29 **	-2.07 **	0.10	-5.15 **	-1.67 *	2.50	-2.62 **
Andalucía	-0.35	-2.07 **	-0.22	-1.35	-0.42	-1.30	-2.07 **	-1.01	0.65	-2.13 **	-0.60	-3.76 **	-1.10	-1.55	-1.55	-1.33	0.44	-2.97 **
Aragón	-0.97	-2.07 **	-1.61	-1.35	-0.98	-1.30	-1.13	-1.01	-2.14 **	-2.13 **	0.83	-3.76 **	-1.96 *	-1.55	-4.24 **	-1.33	-0.40	-2.97 **
Asturias	-2.33 **	-3.15 **	-0.61	-4.60 **	-0.67	-1.50	-1.21	-2.35 **	-1.55	-2.94 **	-2.12 **	-0.08	-3.12 **	-1.14	-2.23 **	-1.10	-1.26	-1.82 *
Baleares	-1.14	-2.56 **	-1.92	-5.29 **	-2.48 **	-2.13 **	-0.65	-3.66 **	-1.36	-2.99 **	-2.14 **	-3.99 **	-2.36 **	-1.13	-7.81 **	-2.44 **	-2.15 **	-3.20 **
Canarias	0.36	-1.23	-2.23 **	-2.03 **	0.40	-2.64 **	-1.13	-0.93	0.95	-2.35 **	-1.86 *	-1.52	-2.47 **	-1.80	-0.93	-2.90 **	-0.24	-1.45
Cantabria	-1.55	-0.98	-2.33 **	-2.04 **	-1.61	-1.78 *	-1.50	-0.75	-0.41	-5.19 **	-1.03	-1.10	-1.79 *	-1.20	-1.86 *	-3.48 **	-2.72 **	-1.50
Castilla-La Mancha	-1.59	-0.74	-1.86 *	-0.22	-1.09	-0.32	-2.95 **	-3.49 **	-0.20	-3.21 **	-0.84	-2.04 **	-1.30	-1.13	-2.73 **	-2.68 **	-1.12	-0.84
Castilla-León	-0.81	-1.47	-1.88 *	-2.70 **	-1.72 *	-2.49 **	-2.86 **	-2.70 **	-3.58 **	-1.31	-2.61 **	-1.17	-1.47	-0.90	-4.53 **	-3.01 **	-1.15	-3.21 **
Cataluña	-1.41	-0.74	-0.57	-0.34	0.06	-1.37	-3.14 **	-1.20	-0.23	-3.33 **	-3.06 **	-2.27 **	-2.93 **	-2.72 **	-2.42 **	-1.66 *	-0.48	-2.43 **
Madrid	-0.85	-2.72 **	-1.05	-0.26	-1.19	-1.38	-2.15 **	-1.50	-2.11 **	-0.66	-1.19	-1.83 *	-0.91	-0.90	-1.60	-1.17	-0.86	-2.00 **
Valencia	-1.44	-2.35 **	-2.74 **	-3.10 **	0.74	-1.15	-0.07	-1.70 **	-1.60	-2.08 **	-1.62	-1.40	-1.66 *	-2.46 **	-2.14 **	-2.60 **	-1.57	-2.27 **
Extremadura	-0.52	-1.74 *	-1.20	-4.93 **	-1.20	-1.76 *	-1.14	-3.12 **	-0.81	-1.63	-0.73	-2.20 **	-0.68	-3.18 **	-2.78 **	-0.57	-1.24	-2.76 **
Galicia	-1.94	-3.25 **	-0.30	-3.63 **	-2.27 **	-1.53	-0.62	-0.42	0.86	-3.98 **	-0.79	-1.93 *	-2.27 **	-1.00	-1.85 *	-0.19	-1.23	-1.53
La Rioja	0.24	-3.39 **	-0.63	-1.85 *	-2.57 **	0.34	-1.08	-3.16 **	0.37	-4.48 **	-0.49	-1.92 *	-1.87 *	-1.39	-2.83 **	-1.53	-0.57	-1.30
Murcia	0.28	-1.78 **	-2.40 **	-3.28 **	-0.31	-2.31 **	-2.62 **	-2.46 **	-0.36	-5.47 **	-1.66 **	-1.31	-3.40 **	-0.26	-1.38	-1.73 *	-1.54	-3.45 **
Navarra	-1.26	-1.41	-0.54	-1.02	-1.69 *	-2.19 **	-1.98 *	-0.54	-1.79 *	-3.41 **	-0.70	-2.14 **	-1.29	-2.27 **	-1.63	-2.07 **	-0.52	-1.75
País Vasco	0.30	0.47	-1.70 *	0.07	-2.43 **	-2.04 **	-2.09 **	-2.02 **	-0.36	-2.99 **	-2.05 **	-1.72 *	-2.78 **	-1.25	-1.58	-2.18 **	-0.89	0.18

Note: Categories refer to INE's eight PROCOME groups. From 2002 onward, the 12 COICOP groups were aggregated to conform with the PROCOME groupings. Data for 1996-2001 were spliced using INE's *coeficientes de enlace* .

1/ Data from 2002 onward have been constructed as the weighted average of *Alimentos y bebidas no alcohólicas* and *Bebidas alcohólicas y tabaco* ; weights stem from CPI (base year 2001).

2/ Data from 2002 onward have been constructed as the weighted average of *Transportes* and *Comunicaciones* ; weights stem from CPI (base year 2001).

3/ Data from 2002 onward have been constructed as the weighted average of *Ocio y cultura* , *Ensenanza* , and *Hoteles, cafes, y restaurantes* ; weights stem from CPI (base year 2001).

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