Persistence of Price-Cost Margins in the U.S. Food and Tobacco Manufacturing Industries: A Dynamic Single Index Model Approach

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Persistence of price-cost margins in the U.S. food and tobacco manufacturing industries is measured while accounting for price-cost margin risk. Direct measurement of persistence and of long- and short-run price-cost margin risk is accomplished by incorporating a partial-adjustment framework into the Single Index Model. Results indicate persistence of price-cost margins. Short-run margin risk is accounted for primarily by diversifiable risk. Long-run margin risk, which depends on systematic risk alone, is generally lower than the short-run measure. Factors influencing persistence and the systematic relationship between industry margins and a market index are explored.

The Pareto optimality of a neoclassical competitive equilibrium has long been used as justification for antitrust enforcement in the United States and competition policy in Canada and Europe. In fact, antitrust enforcement and competition policies typically use the long-run level of equilibrium profits as a measure of Pareto optimality. A market is said to be competitive in the neoclassical sense if the long-run level of economic profit is zero. In such a case, market discipline serves to temper an agent's ability to affect price via free entry and exit. While it has long been recognized that the assumptions needed to utilize the neoclassical model are limiting, attempts have been made to model industry performance while relaxing these assumptions. One area receiving modest attention is the incorporation of risk. Geroski and Jacquemin (1988) provide an example from the industrial organization literature; they measured profit-rate risk using the variance of the error term in a model of profit-rate persistence. Others have measured profit rate risk using alternative measures such as the variance of an asset's return or the covariance of an asset's return with a portfolio return (e.g., Neumann, Bödel, and Haid 1979; Harris 1986; Mueller 1986).

While the cited studies are important in the analysis of firm-level returns, one must not overlook the persistence of industry-level price-cost margins and the variability of such margins relative to a measure of broadly defined market-based risk. For instance, the persistence of price-cost margins in an industry may come about through non-competitive entry barriers or from variability in the price-cost margins, making entry less attractive to potential entrants and thereby allowing existing firms to maintain high price-cost margins. Two points must be recognized here. First, non-competitive market environments do not arise through serendipity; actions taken by decision makers in the food-processing sector can have a direct bearing on the level of return, the risk-return relationship, and the degree of risk within a sector. Second, recognizing that price-cost margins exhibit a risk-return type of trade-off provides antitrust officials with a tool that further enables better differentiation between industries that ought to be investigated (i.e., high average margins with low margin variability) and those that should not be targeted (i.e., high average margins with high margin variability). Presumably such a tool will allow for better allocation of resources in the enforcement of antitrust and competition policy.

The objective of this paper is to measure the persistence of price-cost margins in the U.S. food and tobacco manufacturing industries while accounting for the role of price-cost margin risk (i.e., variability). To achieve this objective, the Single Index Model (SIM) (see Sharpe 1963; Lintner 1965) is modified using a partial-adjustment framework. The resulting dynamic model allows for a characterization of industries according to the variance and persistence of price-cost margins. The SIM approach has been used extensively in analyzing the

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nature of risk in agricultural production (Collins and Barry 1986; Turvey and Driver 1987; Turvey, Driver, and Baker 1988; McKillop 1989; Blank 1990, 1991). However, it has not been used in the context of evaluating the nature of the risk-return trade-off in the U.S. food and tobacco manufacturing industries. Furthermore, use of the partial-adjustment framework allows for a short- and long-run differentiation in the systematic relationship between an industry's price-cost margin and a broader sectoral price-cost margin. Others have modified the SIM to allow for similar intertemporal variation (Fabozzi and Francis 1978; Sunder 1980; Bos and Newbold 1984) using random coefficients or time-varying coefficients. In so doing, past research efforts have developed models wherein risk measures also vary over time. This paper, therefore, contributes to the literature by using the partial-adjustment model to allow for a distinction between short- and long-run measures of risk, thus providing another means to temporally differentiate risk measures.

In the next section, the SIM is modified to reflect partial adjustment of price-cost margins. Data used in the analysis are then discussed. Results are presented and discussed with a focus on the systematic and nonsystematic risk breakdown, delineation between short- and long-run risk characteristics, and persistence of returns. Industry characteristics are then used to explain estimates from the SIM, followed by a concluding section.

A Dynamic Single Index Model Using Partial Adjustment

The Single Index Model (SIM), from Sharpe (1963) and Lintner (1965), can be used to capture the relationship between the return to an individual asset and the return to a market index (i.e., stock market index). This relationship is typically expressed as a linear function with an error term:

$$(1) \qquad r_{it} = \gamma_i + \delta_i r_{mt} + e_{it}$$

where r_{it} is the return to the *i*th asset in period *t*, $i=1,\ldots,n$ indexes the assets, $t=1,\ldots,T$ is a time index, γ_i and δ_i are unknown parameters, r_{mt} is an index representing returns to a market, and e_{it} is an error term associated with the *i*th asset's equation in period *t*. Following convention when estimating a SIM, the return to the *i*th asset is assumed to be independent of the return to the *j*th asset, for all $i \neq j$. The estimated value of δ_i, which measures the expected relationship between the *i*th asset and the index, is referred to as the beta coefficient.

Traditionally, e_{it} is assumed to be independently and identically distributed Normal, with mean zero and variance σ_{ei}^2. Once equation (1) is estimated, the variance for the *i*th asset can be expressed as $\sigma_i^2 = \delta_i^2\sigma_m^2 + \sigma_{ei}^2$, where σ_i^2 is the risk associated with the *i*th asset, σ_m^2 is variance of the market return, $\delta_i^2\sigma_m^2$ is referred to as systematic risk, and σ_{ei}^2 as nonsystematic risk. Systematic risk represents risk that cannot be diversified, while nonsystematic risk can be eliminated through diversification.

Realize, however, that returns to an asset do not necessarily adjust instantaneously to a change in the market return. Market frictions generated through imperfect information, switching costs, transactions costs, and regulations by government and non-government institutions can slow the adjustment of r_{it} to a change in r_{mt}. Given this, it would become apparent that the SIM expressed in (1) ignores the potential for the dynamic behavior of returns generated through partial adjustment to shocks in r_{mt}. In this paper, dynamics are introduced by assuming that the return to an asset follows a partial-adjustment process. In the partial-adjustment framework, returns do not adjust instantaneously to an exogenous shock. Rather, adjustment occurs over multiple periods and is governed by the equation (see Kmenta 1986, 529–30)

$$(2) \qquad r_{it} - r_{it-1} = (1-\lambda_i)(r_{it}^* - r_{it-1}) + e_{it}$$

where $\gamma_i \in (0,1)$ is an unknown parameter that measures the rate of adjustment of r_{it} to r_{it}^*, the long-run (i.e., steady-state) return to the *i*th asset. Here, the long-run return to the *i*th asset is expressed as

$$(3) \qquad r_{it}^* = a_i + b_i r_{mt}$$

where a_i and b_i are coefficients of the SIM when in long-run equilibrium and reflect the relationship between r_{it} and r_{mt} when adjustment in r_{it} is complete. Equation 3 says that the long-run return to the *i*th asset is a linear function of the return to the market.[1]

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[1] Note that if one took the expectations operator through equation (1), it would become clear that g_i and a_i are equivalent, as are d_i and b_i. Thus, equations (1) and (3) are equivalent in expectation.

Since r_{it}^* is not observable, one cannot estimate equation (3). However, substituting (3) into (2) results in

$$(4) \qquad r_{it} - r_{it-1} = (1-\lambda_i)(a_i + b_i r_{mt} - r_{it-1}) + e_{it}$$

which can be simplified to

$$(5) \qquad r_{it} = \alpha_i + \beta_i r_{mt} + \lambda_i r_{it-1} + e_{it}.$$

Since equation (5) represents the process by which r_{it} adjusts to a change in the market return, it is a short-run version of the SIM, where a_i and b_i are the unknown short-run parameters of the SIM. All of the returns shown in (5) can be observed and used to estimate the underlying parameters of the adjustment process (equation 2) and long-run relationship between the *i*th asset and market return (equation 3). Specifically, once a_i, b_i, and λ_i are known, estimates of a_i and b_i can be calculated using the fact that $\alpha_i = (1-\lambda_i)a_i$ and $\beta_i = (1-\lambda_i)b_i$. Thus use of the partial-adjustment model also allows for a differentiation between the short-run beta coefficient (β_i) and the long-run beta coefficient (b_i). Finally, since λ_i measures the rate of adjustment of r_{it} to r_{it}^*, it is interpreted as a measure of the persistence of returns to the *i*th asset. The larger (smaller) the value of λ_i, the more (less) persistent the return.

The variance of the *i*th asset can now be computed in two ways. In the first case, the variance operator is taken through (5) to yield $\sigma_i^2 = \beta_i^2\sigma_m^2 + \lambda_i^2\sigma_i^2 + \sigma_{ei}^2$, which can be stated as

$$(6) \qquad \breve{\sigma}_i^2 = \frac{\beta_i^2}{1-\lambda_i^2}\sigma_m^2 + \frac{\sigma_{ei}^2}{1-\lambda_i^2}.$$

For reasons that will soon become apparent, this last expression is referred to as the transitional (i.e., short-run) variance of the *i*th asset. The first term on the right-hand side of (6) is short-run systematic risk, while the last term is short-run nonsystematic risk. The second way to calculate risk is to note that in the long-run returns are such that $r_{it} = r_{it-1} = r_{it}^*$, which reflects full and complete adjustment. As such, equation (4) can be expressed as

$$(7) \qquad 0 = r_{it} - r_{it-1} = \alpha_i + \beta_i r_{mt} + (\lambda_i - 1)r_{it-1}.$$

Notice that the error term has been omitted in equation (7). This is because when $r_{it} = r_{it-1} = r_{it}^*$ equation (2), which defines the partial-adjustment process becomes $0 = r_{it} = r_{it-1} = (1-\lambda_i)(r_{it}^* - r_{it-1}) + e_{it}$. Since $r_{it}^* - r_{it-1} = r_{it} - r_{it-1} = 0$, then e_{it} must equal zero for all *i* and *t*. Substituting $r_{it-1} = r_{it}$ into (7) and solving for r_{it} results in

$$(8) \qquad r_{it} = \frac{\alpha_i}{1-\lambda_i} + \frac{\beta_i}{1-\lambda_i} r_{mt}.$$

The *i*th asset's variance is now expressed as

$$(9) \qquad \tilde{\sigma}_i^2 = \frac{\beta_i^2}{(1-\lambda_i)^2}\sigma_m^2 = b_i^2\sigma_m^2.$$

Since this last expression is derived assuming returns are in their long-run equilibrium, it is referred to as the steady-state (i.e., long-run) variance. From equation (9) it should be clear that long-run risk is solely accounted for by systematic risk. Consequently, one might expect that the long-run measure of risk, $\tilde{\sigma}_i^2$, would be less than the short-run measure of risk, $\breve{\sigma}_i^2$ as diversification and resolution of uncertainty eliminates nonsystematic risk. Note, however, that the terms multiplied by σ_m^2 differ across the short and long-run measures of risk. One cannot say unambiguously that $\tilde{\sigma}_i^2 < \breve{\sigma}_i^2$, as such a statement depends on the estimates of λ_i and β_i.

The long-run price-cost margin can be derived by taking the expectation operator through equation (8):

$$(10) \qquad \mathrm{E}[r_i] = \frac{\alpha_i}{1-\lambda_i} + \frac{\beta_i}{1-\lambda_i}\mathrm{E}[r_m].$$

In conjunction with $\tilde{\sigma}_i^2$, the long-run price-cost margin can provide insight into whether or nor particular industries have persistent price-cost margins because of the inherent variability of such margins. Moreover, if price-cost margins are persistent with low risk, then scope may exist for investigation related to non-competitive behavior. However, a compelling question asks what factors influence the systematic relationship between the return to an asset and the market return in the short and long run (i.e., β_i and b_i). A number of ideas come to mind, including limited information that forces agents to form expectations in a simplistic manner, credit constraints that limit new capital formation and lessen persistence due to adjustment costs, imperfect competition, and demand factors. These issues are addressed after the results of the SIM are presented.

Data

Equation (5) is estimated using industry-level data for 40 U.S. food and tobacco manufacturing industries. The choice of the 40 industries is motivated by Bhuyan and Lopez (1997), who measured market power in 40 four-digit SIC industries in the U.S. food and tobacco manufacturing sector using a new empirical-industrial organization model. In what follows, results from estimation of equation (5) will be directly related to Bhuyan and Lopez's results though regression analysis. As such, this paper focuses only on the same 40 industries as Bhuyan and Lopez.[2]

Returns, r_{it}, are measured using annual industry-level price-cost margins from 1960 to 1994. Following Domowitz, Hubbard, and Petersen (1986), each industry's price-cost margin (PCM) is computed as

$$PCM = \frac{\textit{Value of Sales} + \Delta \textit{Inventories} - \textit{Payroll} - \textit{Cost of Material}}{\textit{Value of Sales} + \Delta \textit{Inventories.}} \tag{11}$$

Including the change in inventories reflects the notion that the value of sales may differ from the value of output in any given year (Domowitz, Hubbard, and Petersen 1986, 16). By accounting for the change in inventory, the value of any stored output is reflected in the margin. Following Turvey, Baker, and Driver (1988) (and a typical approach when estimating the SIM) the market index r_{mt} is computed as a share-weighted average of industry-level returns—that is, $r_{mt} = \sum_{i=1}^{40} w_{it} r_{it}$—where w_{it} is the industry's share of total returns to the aggregate U.S. food and tobacco manufacturing industry. All price-cost margin data are from the National Bureau of Economic Research web site (1998).

Results

Equation 5 is estimated with Ordinary Least Squares using the SHAZAM econometrics program. Assuming the errors are serially independent, OLS has the appropriate asymptotic properties for estimation of the partial-adjustment model. Regression results, presented in Table 1, show most equations have a good fit. Adjusted R^2 values range from about -0.004 to 0.96, with most values being greater than 0.5. *F* statistics for each regression indicate the null hypothesis that the estimated coefficients are jointly equal to zero is rejected at the 1-percent level. Results from Durbin's *m*-test for first-order auto-correlation, which are not reported to conserve space, indicate the assumption of serially independent errors is supported.

Fourteen of the intercept terms are significantly different from zero, but no discernable sign pattern is evident. Seventeen of the estimates of β_i are significantly different from zero at the 1-percent-significance level, 11 at the 5-percent-significance level, and one at the 10%-percent-significance level. Significant estimates of β_i ranged in value from about 0.06 in the meat packing industry to 1.18 in the condensed and evaporated milk industry. Of the estimated β_i values, 21 are less than 0.5, five are between 0.5 and unity, while three are greater than unity. The latter three estimates occur in the condensed and evaporated milk (SIC 2023), pickled sauces (SIC 2035), and flavor extract and syrup industries (SIC 2087). For these industries the expected change in the price-cost margin is greater than the change in the market index r_{mt} in the short run. The large estimate of the beta coefficient for evaporated milk can be explained by noting this sector has experienced large growth relative to the food and manufacturing sector (see Connor and Schiek 1997, 157). Recall that the beta coefficient measures the relationship between returns to an asset and returns to a market index. If the return to the asset grows faster than the return to the market, the estimated beta coefficient will be larger compared to a case where the return to the asset experienced slower growth. Similarly, prices in the evaporated milk sector have experienced high long-term price increases (Connor and Schiek 1997, 233),

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[2] It should be noted that Bhuyan and Lopez (1997) omitted the following industries from their study: frozen fruit and vegetables, and juice (SIC 2037), wet corn milling (SIC 2046), canned and cured sea foods (2091) and miscellaneous foods (SIC 2099). They do so because "The model [used in their study] either did not satisfy regularity conditions of the cost and/or demand functions or was unable to explain observed data..." (Bhuyan and Lopez 1987, 1038, footnote 8).

which may inflate output prices, and thus price-cost margins. Similar arguments hold for the pickled sauces industry.

Price-cost margin persistence in each industry is measured by the estimate of λ_i. A total of 30 estimates of λ_i are significantly different from zero. Of these, 22 are significant at the 1-percent level of significance, five at the 5-percent level, and three at the 10-percent-significance level. None of the estimates of λ_i are greater than unity (which is expected, based on the theory of partial adjustment), while two estimates are less than zero but insignificant. More than half of the estimates of λ_i range from 0.25 to 0.75, while a number of large values do occur. Of the significant estimates of λ_i, the largest five occur in the pet food (SIC 2047), bread and bakery (SIC 2051), soft drink (SIC 2086), ice cream (SIC 2024) and fluid milk (SIC 2026) industries. The larger the estimate of λ_i, the slower the adjustment of r_{it} to a change in r_{mt} and the more persistent the price-cost margin. Thus one may conclude that price-cost margins persist more in these industries than in other food and tobacco manufacturing industries. The question becomes why are margins persistent? The answer depends on the industry considered. For example, Connor and Schiek (1997, 345) list the pet food industry as having a dominant firm or brand (where dominant firm/brand is defined as one firm holding 10 percent or more of the market). Thus, in the pet food industry, market power may be at play in generating persistent price-cost margins. In the bread and bakery industry, high price increases over the period 1982-1992 (Connor and Schiek 1997, 233) likely contribute to price-cost margin persistence. The same is true for the soft drink industry over the period 1977-1982. This latter industry also has a high advertising-sales ratio (Connor and Schiek 1997, 362) that lends itself to entry barriers that help sustain price-cost margins. An increase in concentration in the ice cream and fluid milk industries would contribute to persistent price-cost margins if such concentration led to a less-competitive environment. Support for this claim is evident in the dairy and milk products sector, where between 1950 and 1984 the Justice Department launched 43 cases investigating local or regional market price-fixing (Connor et al. 1985, 356 and 361).

The smallest significant estimates of λ_i occur in the flavor extract and syrup (SIC 2087), vegetable oil mill (SIC 2076), roasted coffee (SIC 2095), dried fruit and vegetable (SIC 2034), and animal and marine fat (SIC 2077) industries. Since a smaller value of λ_i results in a shorter adjustment period, one may conclude that price-cost margins in these sectors are less persistent. Again, it must be asked why price-cost margins are less persistent in these industries. As an example, consider the roasted coffee industry. Here, negative growth in sales between 1963 and 1972 and between 1982 and 1992 (Connor and Schiek 1997, 174) plays a role if, in response to falling sales, firms lower prices in order to maintain market share. Less-persistent price-cost margins in the animal and marine fat industry may be due to the noted reductions in price between 1977 and 1992 (Connor and Schiek 1997, 235) combined with slow growth. Persistence parameters were not significant in the cheese, condensed and evaporated milk, pickled sauces, rice milling, refined sugar, chocolate and cocoa, chewing gum, cottonseed oil mil, soybean oil mill and tobacco stemming industries. Thus one may conclude that price-cost margins do not persist in these industries.

In general it may be concluded that price-cost margins are persistent in the U.S. food and tobacco manufacturing industries but that no clear pattern emerges. Given the consolidation in the U.S. food and tobacco manufacturing industries, persistence of price-cost margins is not too startling. Notice, however, that the meat (3 digit SIC sector 201), beverage (3 digit SIC sector 208), and processed tobacco products (2 digit SIC sector 21) industries (i.e., not including tobacco stemming) have significantly positive estimates of the persistence parameter. The meat industry has a long history of being targeted for anti-competitive behavior in the United States. Persistence of margins in the alcohol and tobacco sectors is not unexpected given the potential of habit formation in consumption. In the non-alcoholic beverage sector, persistence may also come about from government regulation. For example, the U.S. government has allowed territorial franchises in the bottling and distribution of soft drinks (Connor et al. 1985, 236), thus raising the scope for regional monopoly power that contributes to persistence of margins. (Regional monopoly power may also explain the high advertising-sales ratio in the soft drink industry.) Consolidation has been substantial in these sectors as well—the num-

Table 1. SIM Estimation Results.

SIC	Industry	α	$t(\alpha)^a$	β	$t(\beta)^b$	λ	$t(\lambda)^c$	Adjusted R^2	F
2011	Meat Packing	0.018	1.235	0.058^{**}	2.187	0.513^{**}	2.735	0.307	819^{***}
2013	Saus. & Prep. Meat	0.028^{**}	2.081	0.124^{**}	2.166	0.566^{***}	3.460	0.764	2777^{***}
2016	Poul. & Egg Prod.	0.014	0.763	0.153^{**}	2.270	0.438^{***}	2.792	0.462	432^{***}
2021	Creamery Butter	-0.025	-1.098	0.155^{**}	2.169	0.614^{***}	4.433	0.497	105^{***}
2022	Cheese	-0.018	-1.241	0.349^{***}	4.845	0.107	0.674	0.715	689^{***}
2023	Cond. & Evap. Milk	-0.145^{***}	-5.064	1.182^{***}	6.689	-0.014	-0.094	0.911	1580^{***}
2024	Ice Cream	-0.027	-0.893	0.139^{**}	2.397	0.922^{***}	11.047	0.781	1738^{***}
2026	Fluid Milk	0.010	0.463	0.025	0.706	0.903^{***}	11.610	0.805	3359^{***}
2032	Canned Spec.	0.020	0.743	0.281^{***}	3.181	0.679^{***}	5.513	0.828	3580^{***}
2033	Canned Fr. & Veg.	0.032	1.410	0.364^{***}	3.271	0.441^{***}	2.906	0.776	1958^{***}
2034	Dried Fr. & Veg.	0.057	1.615	0.372^{**}	2.627	0.368^{**}	2.375	0.546	781^{***}
2035	Pickled Sauces	-0.104^{***}	-4.328	1.069^{***}	6.372	0.193	1.535	0.939	2951^{***}
2041	Flour & Grain Mills	0.024	1.183	0.194^{***}	2.773	0.410^{**}	2.562	0.520	729^{***}
2043	Cereal Prep.	0.026	1.142	0.550^{***}	3.330	0.596^{***}	4.636	0.938	7708^{***}
2044	Rice Milling	0.078^{*}	1.915	0.384^{***}	3.005	-0.138	-0.802	0.178	239^{***}
2047	Pet Food	0.045	1.584	-0.113	-0.967	0.996^{***}	16.266	0.937	1726^{***}
2048	Prepared Feed	0.007	0.280	0.056	1.211	0.849^{***}	7.498	0.615	1260^{***}
2051	Bread & Bakery	0.018	1.059	0.020	0.307	0.948^{***}	11.986	0.946	15710^{***}
2061	Refined Sugar	0.174^{**}	2.086	0.074	0.337	0.125	0.706	-0.042	102^{***}
2065	Candy & Confec.	0.030	1.468	0.472^{***}	3.998	0.438^{***}	3.217	0.874	3659^{***}
2066	Chocolate & Cocoa	0.070^{*}	2.019	0.451^{***}	3.221	0.271	1.550	0.579	1059^{***}
2067	Chewing Gum	0.339^{***}	4.397	0.278^{**}	2.233	0.137	0.726	0.224	2433^{***}
2074	Cottonseed Oil Mill	0.029	0.463	0.228	1.209	0.125	0.729	0.012	40^{***}
2075	Soybean Oil Mill	0.018	0.493	0.111	1.039	0.141	0.803	-0.004	35^{***}
2076	Vegetable Oil Mill	0.046	0.871	0.086	0.563	0.300^{*}	1.780	0.049	48^{***}
2077	Anim. & Marine Fat	0.075^{*}	1.769	0.162	1.474	0.384^{**}	2.435	0.206	380^{***}
2079	Lard & Cooking Oil	-0.001	-0.071	0.273^{***}	3.128	0.477^{***}	3.290	0.712	878^{***}
2082	Malt Beverages	-0.056^{**}	-2.142	0.345^{***}	3.690	0.829^{***}	12.772	0.911	1961^{***}
2084	Wine & Brandy Spec.	0.101^{**}	2.067	0.308^{**}	2.322	0.393^{**}	2.510	0.385	810^{***}
2085	Distilled Liquor	0.136^{**}	2.543	0.228^{**}	2.092	0.531^{***}	3.747	0.511	2272^{***}

SIC	Industry	α	$t(\alpha)^a$	β	$t(\beta)^b$	λ	$t(\lambda)^c$	Adjusted R^2	F
2086	Soft Drinks	0.001	0.035	0.046	1.220	0.947***	20.931	0.935	9672***
2087	Flavor Extr. & Syrup	0.074***	2.966	1.095***	6.578	0.217*	1.792	0.940	8555***
2092	Fresh Fish Prep.	0.062*	1.985	0.077	1.225	0.537***	3.611	0.306	875***
2095	Roasted Coffee	-0.031	-0.906	0.744***	4.179	0.304*	1.982	0.754	905***
2097	Manufactured Ice	0.061	0.876	0.394*	1.968	0.517***	3.573	0.417	448***
2098	Macaroni & Spaghe.	0.023	0.871	0.384**	2.685	0.580***	4.179	0.822	2149***
2111	Cigarettes	-0.037	-1.609	0.737***	3.774	0.635***	6.244	0.962	7078***
2121	Cigars	0.042	1.030	0.401***	3.009	0.548***	3.866	0.669	1431***
2131	Chew. & Smok. Tobc.	-0.048	-1.114	0.806**	2.285	0.590***	3.216	0.883	1930***
2141	Tobacco Stemming	-0.179**	-2.587	0.727***	3.208	0.192	1.125	0.409	25***

*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.
[a] $t(\alpha)$ is the t-statistics for the intercept.
[b] $t(\beta)$ is the t-statistics for the beta coefficient.
[c] $t(\lambda)$ is the t-statistics for the persistence term.

ber of meat packers in the U.S. almost halved between 1963 and 1992 and, except for wine and brandy industry, the number of firms in the beverage sector has fallen precipitously. Moreover, in the dairy sector (3 digit SIC sector 202), if the estimate of λ_i is significant, margins tend to be very persistent (e.g., ice cream and fluid milk have estimates of λ_i greater than 0.9). Again, industry consolidation and government intervention may have contributed to persistent margins through the use of marketing orders and government programs that remove products from the market place (e.g., the Women-Infants-Children program). In the fruit and vegetable sector (3 digit SIC sector 203) persistence tends to be lower, while in the grain sector (3 digit SIC sector 204) persistence varies widely. The latter two groupings have also shown a lesser degree of concentration compared to the meat-packing or beverage industries. The fruit and vegetable sector also seems to be less of a target of anti-trust attention. For instance, between 1961 and 1966, the Department of Justice launched 31 cases against the fruit and vegetable sector, but only 16 between 1966 and 1984 (Connor et al. 1985, 357). Maturity of the fruit and vegetable industries may be a contributing factor here (see, for example, Sutton's 1991 discussion of the evolution of the frozen-vegetable sector).

Focus now shifts to examining the short- and long-run measures of risk. Table 2 shows the sample average price-cost margin for each industry, estimates of β_i, the transitory standard deviations and their component shares (i.e., the share of total risk attributed to systematic and nonsystematic risk), implied values of b_i with corresponding *t* statistics, and the steady-state standard deviation (computed using equation 9). Following Ben-Horin and Levy (1980), risk is measured in standard deviations rather than variances, as the former are easier to interpret. Except for the tobacco stemming (SIC 2141) and pet food industries, all transitory standard deviations are less than the average price-cost margins in the respective industries. In the pet food industry the latter result comes about from a large estimate of λ_i, which means $1-\lambda_i^2$ is small, so the transitory standard deviation is large. In the tobacco stemming industry this result comes about primarily from a small average price-cost margin. In most instances nonsystematic (i.e., diversifiable) risk accounts for the majority of total risk. Exceptions

Table 2. SIM Measures of Risk.

SIC No.	Industry	PCM	β	Transitory standard deviation	Systematic share	Non-systematic share	*b*	t(b)^{a}	Steady-state standard dviation
2011	Meat Packing	0.075	0.058	0.014	0.281	0.719	0.120*	1.974	0.007
2013	Saus. & Prep. Meat	0.158	0.124	0.022	0.420	0.580	0.287***	4.207	0.017
2016	Poul. & Egg Prod.	0.114	0.153	0.031	0.325	0.675	0.272***	2.803	0.016
2021	Creamery Butter	0.066	0.155	0.041	0.284	0.716	0.402**	2.111	0.024
2022	Cheese	0.110	0.349	0.036	0.589	0.411	0.390***	8.348	0.023
2023	Cond. & Evap. Milk	0.244	1.182	0.093	0.765	0.235	1.165***	18.817	0.070
2024	Ice Cream	0.243	0.139	0.074	0.293	0.707	1.787	0.836	0.107
2026	Fluid Milk	0.203	0.025	0.032	0.113	0.887	0.262	0.548	0.016
2032	Canned Spec.	0.342	0.281	0.050	0.461	0.539	0.876***	4.071	0.053
2033	Canned Fr. & Veg.	0.270	0.364	0.048	0.509	0.491	0.651***	6.023	0.039
2034	Dried Fr. & Veg.	0.283	0.372	0.062	0.389	0.611	0.588***	3.703	0.035
2035	Pickled Sauces	0.309	1.069	0.086	0.762	0.238	1.325***	18.384	0.079
2041	Flour & Grain Mills	0.148	0.194	0.033	0.381	0.619	0.329***	3.542	0.020
2043	Cereal Prep.	0.506	0.550	0.066	0.624	0.376	1.363***	9.107	0.082
2044	Rice Milling	0.180	0.384	0.064	0.364	0.636	0.337***	3.343	0.020
2047	Pet Food	0.326	-0.113	0.405	0.193	0.807	-30.179	-0.058	1.809
2048	Prepared Feed	0.164	0.056	0.036	0.173	0.827	0.368	0.840	0.022
2051	Bread & Bakery	0.410	0.020	0.039	0.095	0.905	0.379	0.479	0.023
2061	Refined Sugar	0.227	0.074	0.081	0.055	0.945	0.084	0.336	0.005
2065	Candy & Confec.	0.328	0.472	0.052	0.602	0.398	0.840***	8.687	0.050
2066	Chocolate & Cocoa	0.299	0.451	0.061	0.461	0.539	0.619***	4.983	0.037
2067	Chewing Gum	0.501	0.278	0.052	0.325	0.675	0.323***	2.776	0.019
2074	Cottonseed Oil Mill	0.120	0.228	0.079	0.174	0.826	0.260	1.229	0.016
2075	Soybean Oil Mill	0.064	0.111	0.044	0.152	0.848	0.130	1.032	0.008
2076	Vegetable Oil Mill	0.107	0.086	0.061	0.089	0.911	0.123	0.566	0.007
2077	Anim. & Marine Fat	0.210	0.162	0.050	0.208	0.792	0.262	1.521	0.016
2079	Lard & Cooking Oil	0.169	0.273	0.041	0.453	0.547	0.523***	4.766	0.031
2082	Malt Beverages	0.335	0.345	0.085	0.437	0.563	2.021***	3.192	0.121

SIC No.	Industry	PCM	β	Transitory standard deviation	Systematic share	Non-systematic share	*b*	t(b)[a]	Steady-state standard deviation
2084	Wine & Brandy Spec.	0.334	0.308	0.064	0.315	0.685	0.508**	2.661	0.030
2085	Distilled Liquor	0.447	0.228	0.054	0.298	0.702	0.485**	2.459	0.029
2086	Soft Drinks	0.347	0.046	0.046	0.184	0.816	0.869	0.718	0.052
2087	Flavor Extr. & Syrup	0.558	1.095	0.089	0.759	0.241	1.399***	17.927	0.084
2092	Fresh Fish Prep.	0.185	0.077	0.031	0.177	0.823	0.166	1.226	0.010
2095	Roasted Coffee	0.308	0.744	0.084	0.555	0.445	1.069***	7.169	0.064
2097	Manufactured Ice	0.394	0.394	0.103	0.269	0.731	0.815**	2.096	0.049
2098	Macaroni & Spaghe.	0.351	0.384	0.060	0.468	0.532	0.915***	5.117	0.055
2111	Cigarettes	0.554	0.737	0.087	0.658	0.342	2.019***	10.670	0.121
2121	Cigars	0.382	0.401	0.070	0.409	0.591	0.888***	3.782	0.053
2131	Chew. & Smok. Tobc.	0.522	0.806	0.111	0.538	0.462	1.966***	6.594	0.118
2141	Tobacco Stemming	0.076	0.727	0.108	0.411	0.589	0.900***	4.047	0.054

*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.
[a] t(b) is the t-statistics for the estimate of *b*.

occur in the cheese (SIC 2022), condensed and evaporated milk (SIC 2023), canned fruit and vegetable (SIC 2033), pickled sauces (SIC 2035), cereal preparation (SIC 2043), candy and confectionery (SIC 2065), flavor extract and syrup (SIC 2087), roasted coffee (SIC 2095), cigarette (SIC 2111), and chewing and smokeless tobacco (SIC 2131) industries, where systematic risk accounts for more than half of total short-run risk.

Of the significant estimates of b_i, 23 are significant at the 1-percent level, four at the 5-percent-significance level, and one at the 10-percent level. Most estimates of the systematic *long-run* relationship between an industry's margin and the market margin (i.e., b_i) are larger than the short-run estimates (i.e., β_i). For example, only three estimates of β_i are greater than unity, while eight estimates of b_i are greater than unity. Furthermore, 11 estimates of b_i are greater than 0.5 but less than unity, while only five estimates of β_i have values between 0.5 and unity. These results are expected since, in the long-run, uncertainty is resolved and frictions preventing adjustment are eliminated, therefore one would expect a stronger systematic relationship. However, exceptions occur in the condensed and evaporated milk, pet food, and rice milling industries, where a weaker long-run relationship is measured—a result directly attributed to the respective estimates of λ_i for these industries.

Except for the pet food industry, steady-state standard deviations are all less than the average price-cost margins. In most cases, the steady-state standard deviation (i.e., the long-run measure of risk) is actually lower than the transitory standard deviation (i.e., the short-run measure of risk). Instances where long-run risk is less than short-run risk come about when elimination of nonsystematic risk in the long run more than offsets the increase in systematic risk that arises through higher values of b_i relative to β_i. Exceptions include the ice cream, canned specialties (SIC 2032), cereal preparation, pet food, malt beverages (SIC 2082), soft drink, cigarette, and chewing and smokeless tobacco industries, where steady-state standard deviations are larger than transitory standard deviations. In these exceptions, large values of b_i relative to β_i more than offset the elimination of nonsystematic risk. This is especially relevant in the ice cream, pet food, and soft drink industries, where more than half of total short-run risk is due to nonsystematic risk.

Table 3 again shows the sample average price-cost margin, the expected long-run price-cost margin computed using equation (10), and the percentage difference between the two. In some instances, there is little or no difference between the sample average and expected long-run margin. For example, the percentage difference between $\mathrm{E}[r_i]$ and the sample average price-cost margin in the cheese industry is 0.23%, although the estimate of the persistence parameter for this industry is insignificant. In most industries the expected long-run price-cost margin is higher than the sample average price-cost margin. Two extreme examples are the pet food and bread and bakery industries. In the former, $\mathrm{E}[r_i]$ is 530% higher than the sample average price-cost margin, while in the bakery industry the percentage difference is 16%. In both of these industries the persistence parameter λ_i is extremely large. Note, however, that for the condensed and evaporated milk, fluid milk, vegetable oil milling, animal and marine fat, and soft drink industries the expected long-run price-cost margin is actually lower than the sample average price-cost margin. The soft drink industry is rather interesting, as the expected long-run price-cost margin is about 12% less than the sample average price-cost margin. The use of exclusive territories appears to have enabled manufacturers in the soft drink industry to realize high margins in the short run, which subsequently fall in the long run.

As a final step in considering the long-run relationship between price-cost margins and margin risk consider Figure 1, which plots values of $\mathrm{E}[r_i]$, σ_i (the steady-state standard deviation), and a trend line between the two series. (Given the large values of $\mathrm{E}[r_i]$ and σ_i in the pet food industry, this industry was dropped from Figure 1.) As expected, a positive relationship exists between the long-run price-cost margin and long-run systematic risk (as measured by the steady-state standard deviation). Overall results suggest that within the U.S. food and tobacco manufacturing industries there is a lower level of long-run systematic risk (compared to the short run), but that higher long-run price-cost margins compensate for risk.

Given these results, it would be prudent for antitrust agencies to exercise caution in investigating industries with high price-cost margins without giv-

Figure 1. Steady State Standard Deviation as the Long-Run Price-Cost Margin Varies.

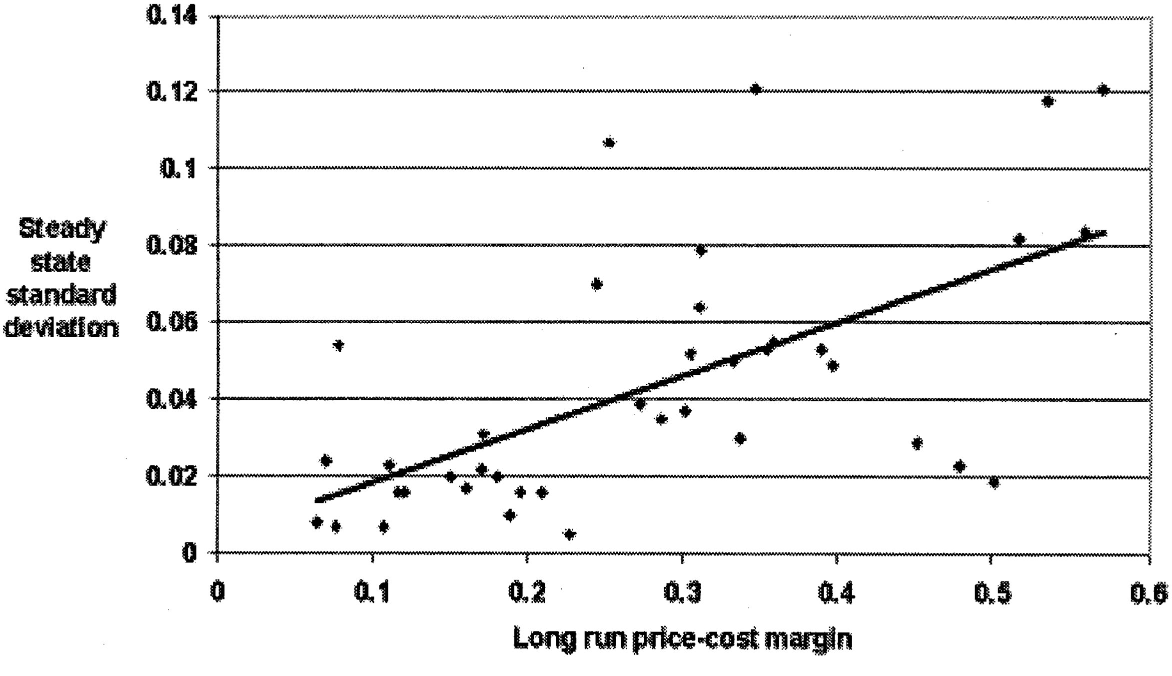

Table 3. Comparison of Average Price-Cost Margins and Expected Long-Run Price-Cost Margin.

SIC No.	Industry	Average PCM	Predicted long-run PCM	Percent difference between predicted long-run PCM and average PCM
2011	Meat Packing	0.075	0.076	1.437
2013	Saus. & Prep. Meat	0.158	0.160	1.341
2016	Poul. & Egg Prod.	0.114	0.116	1.409
2021	Creamery Butter	0.066	0.069	4.107
2022	Cheese	0.110	0.110	0.225
2023	Cond. & Evap. Milk	0.244	0.244	-0.033
2024	Ice Cream	0.243	0.252	4.054
2026	Fluid Milk	0.203	0.195	-3.797
2032	Canned Spec.	0.342	0.353	3.207
2033	Canned Fr. & Veg.	0.270	0.272	0.983
2034	Dried Fr. & Veg.	0.283	0.285	0.669
2035	Pickled Sauces	0.309	0.311	0.534
2041	Flour & Grain Mills	0.148	0.150	0.989
2043	Cereal Prep.	0.506	0.517	2.293
2044	Rice Milling	0.180	0.180	-0.144
2047	Pet Food	0.326	2.055	530.914
2048	Prepared Feed	0.164	0.170	3.355
2051	Bread & Bakery	0.410	0.479	16.785
2061	Refined Sugar	0.227	0.227	0.113
2065	Candy & Confec.	0.328	0.332	1.096
2066	Chocolate & Cocoa	0.299	0.301	0.578
2067	Chewing Gum	0.501	0.501	0.012
2074	Cottonseed Oil Mill	0.120	0.120	0.218
2075	Soybean Oil Mill	0.064	0.064	0.206
2076	Vegetable Oil Mill	0.107	0.107	-0.134
2077	Anim. & Marine Fat	0.210	0.209	-0.133
2079	Lard & Cooking Oil	0.169	0.171	1.175
2082	Malt Beverages	0.335	0.346	3.346
2084	Wine & Brandy Spec.	0.334	0.336	0.558
2085	Distilled Liquor	0.447	0.451	0.777
2086	Soft Drinks	0.347	0.304	-12.394
2087	Flavor Extr. & Syrup	0.558	0.559	0.335
2092	Fresh Fish Prep.	0.185	0.188	1.399
2095	Roasted Coffee	0.308	0.310	0.573
2097	Manufactured Ice	0.394	0.396	0.447
2098	Macaroni & Spaghe.	0.351	0.358	2.052
2111	Cigarettes	0.554	0.570	2.793
2121	Cigars	0.382	0.389	1.694
2131	Chew. & Smok. Tobc.	0.522	0.535	2.510
2141	Tobacco Stemming	0.076	0.077	1.215

ing due consideration to the level of risk. Added risk in some industries may be offset by higher margins—a lesson firmly cemented in the finance literature. Targeting firms or industries merely on the basis of the price-cost margins, and without due regard to the level of risk or price-cost variability, may result in wasteful use of prosecutorial resources. Recognize, of course, that actions taken by decision-makers and the market environments within which actions are taken drive the empirical results discussed above. Attention now focuses on how factors under the control of decision-makers, or reflective of market conditions, affect the estimated relationships.

Factors Affecting the Systematic Relationship and Persistence

The SIM with partial adjustment fails to address the question of what factors affect the values of β_i, b_i, and λ_i. To investigate this relationship, estimates of each industry's β_i, b_i, and λ_i are regressed on factors under the control of decision-makers or reflective of market conditions and industries considered. Such an approach has been used in previous persistence studies (e.g., Cubbin and Geroski 1987; Geroski and Jacquemin 1988; Kambhampati 1995) and in assessing factors which influence trade elasticities (e.g., Blonigen and Wilson 1999). The regressors include the industry-level conjectural-variation elasticity, the absolute value of the own-price demand elasticity, the Lerner Index of oligopoly power, a measure of scale elasticity, capital intensity, sales-and-promotion intensity, R&D intensity, the import intensity, and the export intensity. Including the conjectural-variation elasticity controls for strategic interaction between firms within an industry. The absolute value of the own-price demand elasticity accounts for differences in the nature of demand, while interaction between the conjectural-variation elasticity and demand elasticity is captured by including the Lerner Index of oligopoly power. The scale-elasticity variable is included to reflect inter-industry cost-structure differences and cost-based entry barriers (e.g., minimum efficient scale). Sale-and-promotion-intensity and R&D-intensity variables are included to account for product differentiation as well as for investment in product and/or process innovation. Capital intensity is included to account for any capital-specific entry barriers, while import and export intensities account for the role of trade.

One would expect more persistence in less-competitive industries, so a positive relationship is expected between λ_i and factors contributing to market power. Import intensity is expected to reduce persistence by expanding the effective number of firms in the market, while export intensity is expected to encourage persistence. Since market power may have developed to cope with systematic risk (i.e., risk that cannot be diversified), a positive relationship is expected between estimates of β_i and b_i and factors contributing to market power. Both import and export intensities are expected to have a negative relationship with estimates of β_i and b_i, as trade may increase an industry's exposure to exogenous shocks that increase the extent of nonsystematic risk, thereby weakening the systematic relationship.

Values for the conjectural-variation elasticity, demand elasticity, Lerner Index, and scale elasticity are obtained from Bhuyan and Lopez (1997, 1039-40), while sales-and-promotion and R&D intensities obtained from Connor et al. (1985, 90). Capital intensity, which is measured as the ratio of current-period capital stock to real output, is computed from data available at the NBER web site, which served as the source of the SIC data. Both the import and export intensity measures are computed from data obtained from trade data available though the National Bureau of Economic Research (2000).

To avoid the introduction of heteroskedasticity, estimates of β_i, b_i, and λ_i are divided by the respective standard errors and then regressed on industry characteristics using OLS. The second column in Table 4 shows results for the regression of β_i on industry characteristics. While the adjusted R^2 is low, the null hypothesis that the estimated parameters are jointly equal to zero is rejected at the 1-percent level. Coefficients on the Lerner Index, the demand elasticity, and R&D intensity are significantly positive, while coefficients on the conjectural-variation elasticity and capital intensity are significantly negative. An increase in the demand elasticity, oligopoly power, or R&D intensity strengthens the systematic relationship between r_{mt} and the respective industry-level price-cost margin. All other things being equal, an increase in this systematic relationship increases the level of systematic risk and reduces the share of risk accounted for by nonsystematic risk. Consequently, industries with more price-sensitive consumers, larger measures of market power, and more R&D activities face comparatively greater systematic risk, which limits the extent to which risk can be eliminated through diversification.

However, an increase in the conjectural-variation elasticity or capital intensity lowers the estimate of β_i, *ceteris paribus*. This means non-systematic risk accounts for a larger share of total risk in industries with higher capital intensities or a lower conjectural-variation elasticity. Since capital intensity reflects the advent and adoption of newer technologies, it may be that decisions not to adopt new or unproven technologies (thereby lowering the level of capital intensity) reflects a desire by decision makers to reduce the share of total risk accounted for by idiosyncratic risk. It may seem counterintuitive to conclude that firms reduce diversifiable risk by not adopting new technologies. However, such a conclusion is plausible for technologies with unproven performance records, or if firms do not wish to commit capital to an uncertain investment. (This is, in fact, an empirical question open to further research.) The result for the conjectural-variation elasticity is the opposite to that of the Lerner index. Remember, however, that the Lerner index reflects the role of the demand elasticity. Given different signs on coeffi-

Table 4. Cross-section regression results[a].

	β-regression	λ-regression	*b*-regression
Constant	-0.436 (-0.155)	12.930* (1.847)	-1.854 (-0.234)
Conjectural variations elasticity	-19.070** (-2.115)	25.126 (1.123)	-45.789* (-1.812)
Own-price demand elasticity	5.925* (1.669)	-11.781 (-1.338)	15.681 (1.576)
Lerner index	15.179** (2.564)	-3.891 (-0.265)	43.550** (2.624)
Scale elasticity	-0.994 (-0.642)	-4.297 (-1.119)	-5.459 (-1.258)
Capital intensity	-2.689* (-1.871)	6.786* (1.903)	-9.031** (-2.241)
Sales and promotion intensity	-0.035 (-0.728)	0.262** (2.226)	-0.065 (-0.485)
Research and development intensity	2.609* (1.824)	-10.609*** (-2.988)	7.059* (1.760)
Import intensity	-1.580 (-0.407)	-27.736*** (-2.879)	-4.925 (-0.452)
Export intensity	0.175 (0.064)	-10.861 (-1.598)	2.661 (0.347)
Adjusted R^2	0.112	0.317	0.173
F-statistics	12.653***	7.946***	6.140***

*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.
[a] Values in parentheses are t-statistics.

cients for the Lerner Index and the conjectural-variation elasticity, it would seem that the role of demand elasticities in shaping the short-run systematic relationship between r_{it} and r_{mt} is further strengthened.

The third column in Table 4 shows results from regressing λ_i on the industry characteristics. While the adjusted R^2 is also low for this equation, the joint null hypothesis that the coefficient estimates are equal to zero is rejected at the 1-percent level. Coefficients on capital and sales-and-promotion intensities are significantly positive, while those on the R&D and import intensities are significantly negative. Thus industries with higher capital and sales-and-promotion intensities have more persistent price-cost margins, which suggests these factors may be important in forestalling entry. The impact of the sales-and-promotion intensity on persistence has been studied in the Structure-Conduct-Performance literature, wherein advertising can be viewed as a means of product differentiation that generates product loyalty. Presumably, product loyalty results in consumers that are not as price sensitive, thus allowing firms to charge persistently higher prices. However, industries with higher R&D and import intensities have less persistent profits. The negative relationship between λ_i and the R&D intensity may result from R&D activities that result in new products which cannibalize existing product lines, which seems plausible given that new products are often developed for existing product lines. The import-variable result is expected, as trade can be viewed as a form of entry, thereby limiting the extent to which existing firms can act in a manner that results in persistent margins.

Finally, results of the regression of b_i on the industry characteristics are shown in the last column of Table 4. The adjusted R^2 from this regression is about 0.2, while the joint null hypothesis that the estimates are significantly different from zero is rejected at the 1-percent level. Not only do the coefficient estimates have the same sign as in the β_i regression, but, with one exception, the same coefficients are also significant. The exception is for the demand elasticity, which is not significant in the long-run beta-coefficient regression. The estimated coefficients in the b_i regression are also larger, in absolute value, than those in the β_i regression, which reflects the long-run nature of b_i.

Summary and Conclusions

The objective of this paper was to measure the persistence of price-cost margins in the U.S. food and tobacco manufacturing industries while accounting for the role of price-cost margin risk. To achieve this objective, the Single Index Model (SIM) was modified using a partial-adjustment framework. Using four digit SIC data for 40 U.S. food and tobacco manufacturing industries, results suggest that in general price-cost margins are persistent in the U.S. food and tobacco manufacturing industries but that no clear pattern emerges. Furthermore, the systematic short-run relationship between industry-level and market-level price-cost margins is weak. As such, much of the short-run risk present in each industry was attributed to nonsystematic risk, thus suggesting scope for elimination of risk through diversification. Recent merger and acquisition activity across different food and tobacco manufacturing industries and other sectors of the economy supports this argument. However, when a long-run perspective is taken, industry-level price-cost margin risk is attributed solely to systematic risk. Most estimates of the systematic long-run relationship between industry and market price-cost margins are larger than the corresponding short-run measures. Nevertheless, long-run price-cost margin risk tends to be smaller than the corresponding short-run measures, reflecting the elimination of non-systematic risk in the long run.

Further analysis indicates that industries with higher capital and sales-and-promotion intensities have more persistent price-cost margins. One implication is that investment in capital inputs, such as those facilitating electronic data interchange, supply-chain management systems to support efficient consumer response, or technologies enabling value-adding activities by food manufacturers, may further increase persistence of margins. Likewise, replacement of older capital assets may also add to persistence, as will activities supporting differentiation of products, such as advertising and promotion. Results also show that industries with high R&D and import intensities have less persistent profits. That increasing import intensity reduces persistence makes intuitive sense. Recognize, however, that as free-trade agreements evolve and expand, the relative volume of imports shipped into the U.S. may increase. If this increase comes about through importation of value-added food products, the negative relationship between imports and persistence may be exacerbated.

The systematic relationship between industry price-cost margins and the market index is positively influenced by price sensitivity of consumers (as measured by demand elasticities), degree of oligopoly power, and R&D intensity, but negatively affected by the conjectural-variations elasticity and capital intensity. Product differentiation, as measured through the demand elasticity, development of market power, and investment in product or process innovation (as measured through R&D), also amplifies the relationship between industry price-cost margins and the market index. This means that industries with price-sensitive consumers, market power, and substantial R&D investment will experience larger price-costs increases when the market index grows, but also larger reductions in price-cost margins when the market index falls. As such, these industries also face greater systematic risk, which makes it more difficult to eliminate risk via diversification. That strategic interaction and capital investment lowers the systematic relationship between an industry's price-cost margin and the market index suggests that industries with increasing concentration have potentially greater scope for diversification. To see why, note that increased concentration typically comes about through a reduction in the number of firms but an increase in plant capacity. Since firms left in the market interact with fewer firms, the scope for strategic interaction increases (which means the conjectural-variation elasticity rises) and plant capacity must rise (which requires additional capital investment). In this case, a business that survives industry rationalization may leave itself open to additional risk related to potential failures (or downturns) in the expanded enterprise. Since these additional risks will take the form of nonsystematic risk, remaining firms may seek out diversification opportunities with offsetting risks in the hopes that portfolio effects offer some measure of protection against downturns in the expanded enterprise.

The motivation for this paper was the idea that Pareto optimality of a neoclassical competitive equilibrium has been used as justification for antitrust enforcement in the United States and competition policy in Canada and Europe. Results from this study support the notion of relaxing the assumption of the neoclassical framework. In particular, relaxing the assumption of a static, certain environment serves to strengthen this framework as a tool for antitrust investigation and enforcement. Recognizing that price-cost margins exhibit a risk-return trade-off provides antitrust officials with a tool that enables them to better differentiate between industries or firms that ought to be investigated (i.e., high margins with low risks) and those that ought not to be targeted (i.e., high margins and high risks). Presumably, such a tool will allow for better allocation of resources in the enforcement of antitrust and competition policy.

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